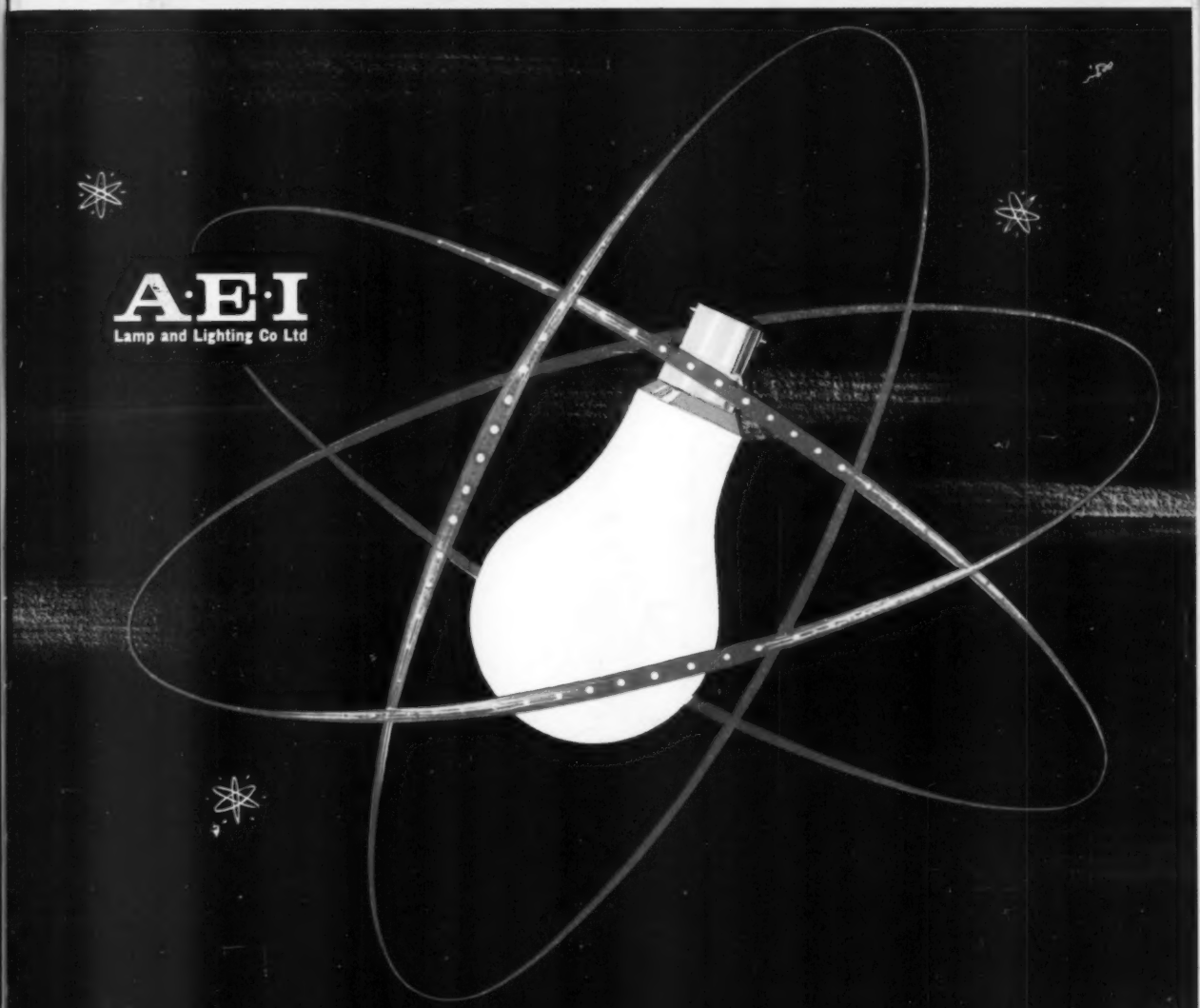
PROGRESS IN LIGHTING

# ELECTRICAL REVIEW

FRIDAY
SEPTEMBER 1959

WEEKLY
PRICE 1s 6d


**Mazda** *lamps stay brighter longer*

Head Office: Melton Road, Leicester

## Clean conditions at Berkeley

Boilermaking is not usually associated with clinical cleanliness. But with nuclear power plant, conditions are different. In the heat-exchangers at Berkeley Nuclear Power Station, John Thompson's men are working in special clothing, with clean white gloves. They enter the vessels through sealed "penthouses" erected at the top of the heat-exchangers. The tube packs, which they fit into the vessels, arrive in sealed polythene wrappings. No incompatible materials are allowed to enter. The atmosphere is controlled — no corrosion must occur.

This is just another example of careful planning, work done to schedule, and an ability *to get on with the job no matter what the conditions*. It is typical of John Thompson.

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ELECTRICAL REVIEW

18 September 1959 Vol. 165 No. 6 Established 1872

# More and Better Lighting

AT about this time for many years past we have given particular prominence to lighting matters, for from the point of view of the generating side of the industry alone, apart altogether from the interests of the manufacturers of lamps and lighting equipment, lighting deserves at least this special attention. But now we are joined each autumn by more and more of the women's journals, each devoting an increasing amount of space to this subject which has been " discovered " to be of prime importance in domestic life. We do not necessarily agree with all the schemes and suggestions put forward in these magazines, but we do most heartily approve their growing interest. It is a welcome sign of the times.

Since war restrictions were lifted, an astonishing change has come over lighting, largely perhaps because customer resistance has perceptibly weakened. For everyone concerned, it is no longer a bread-and-butter line, but a profitable " snowball " business with virtually no saturation point. Every good lighting installation breeds others; every satisfied customer eventually comes back for more. True, much light and good lighting are still sometimes confused, but one cannot have the second without the first.

The shop lighting campaign being run this year by the British Lighting Council, if energetically supported and followed up by the interested parties, will certainly have a profound effect on raising the standard of lighting of the smaller shops. The new shop lighting equipment that the manufacturers have recently produced—especially perhaps the low voltage spot lighting apparatus which has an amazing punch for its size—should be able to tempt many a shopkeeper into using light positively to help his sales; and if, as seems likely, some of this lighting equipment is provided in a form in which it can be plugged in without the necessity for skilled installation work, its appeal will be all the greater. The fact that small shop lighting at present comes on at peak load times, and must continue to do so, will, with the advent of nuclear stations, become of less importance than the fact that more and better lighting is automatically used for longer hours, improving the load factor.

The evidence of hundreds of new buildings springing up in London and throughout the rest of the country shows that architects are still preoccupied with the problems of natural daylight. Many of these problems

would disappear if it were more generally realised that daylight as an interior illuminant cannot in many respects rival electric lighting. We believe, therefore, that a conference with this theme for architects, which we understand the British Lighting Council is organising for next spring, may have a profound influence on the shape of things to come, not only by spreading the light in more senses than one, but also by encouraging the revision or removal of some of the restrictions which in the past may have been necessary to ensure adequate daylight within buildings.

## APPLICATION OF STANDARDS

There is obviously no point in producing specifications for standards if they are not employed to the fullest advantage by industry. From the recently published annual report of the British Standards Institution, however, it is evident that the importance of using standards effectively in production is being increasingly recognised. It is encouraging to note from this report that efforts are continuing to ensure as close contact as possible between the Institution and those who use standards as well as to promote education in standardisation through conferences and discussion groups on various levels in industry, and also among students.

One useful forum for raising problems of standards application and for bringing to the attention of the B.S.I. some of the problems encountered in translating British Standards into company standards, and possible improvements in the presentation or other features of British Standards, is the Joint Committee of the Institution of Production Engineers and the B.S.I. We feel that the B.S.I. is doing a great deal to ensure the right attitude towards standards by the encouragement which it is giving to technical colleges to place emphasis on standards techniques in their courses, whether in management or engineering subjects.

## LIGHTING DESIGN

Although the design of a complex lighting installation is best left to qualified lighting engineers, there are many occasions when it would be impracticable to call on the services of a lighting engineer and the ordinary engineer has perforce to carry out his own calculations. For example, consulting engineers covering power station projects usually carry out their own illumination design, and works engineers are often called on to provide new lighting arrangements for workshops.

There are, therefore, many engineers who occasionally require to carry out a simple, usually utilitarian, interior lighting design in the course of their more normal duties. When this infrequent need arises, they are generally driven to re-reading textbooks and it is for these people that we include a supplement in this issue giving a concise simplified guide to the necessary calculations. When compiling this data sheet, we decided to include definitions and general formulæ to provide some background. This will, we hope, also be of some use to students.

**BLANKETS AND PADS**

Next week's issue will contain an illustrated survey of the range of electric blankets and pads now available for domestic use. The details to be given will include size, material, colour, loading, method of control, special features and price

## SCIENTISTS' RESPONSIBILITIES

Among the many aspects of the various branches of present-day science that were discussed, both in public forum and privately between attending delegates, at the recent annual meeting of the British Association for the Advancement of Science at York, was the question of the responsibilities with which scientists can be charged. Some of the more obvious concern the exploitation of new scientific developments to the material advantage of the community as a whole, and these are becoming more important as a result of the increasing tendency to present science as a technique leading to the improvement of material living standards.

Although complaints from scientists that their discoveries have been misapplied or not fully utilised are not unknown, past experience has shown that in the majority of cases the inventor cannot handle the problems of application. The techniques of research and development, and the more commercial procedures associated with production, marketing and utilisation, are generally too dissimilar to be efficiently encompassed by a single mind with but one training and experience. What is needed is the imparting of sufficient technical knowledge to non-scientific executives who will control the production and application of a discovery to ensure that all its implications are fully appreciated.

## "PUBLIC ACCOUNTABILITY" AGAIN

The Select Committee on Nationalised Industries (Reports and Accounts) was first set up in 1956 to keep an eye on the operations of the boards controlling the nationalised industries and to form a link between those industries and Parliament. Although the Committee has found the boards very co-operative its members now feel that without the help of specialists they cannot carry out their duties effectively in the time available to them.

In a report published last week* the Committee discusses the nature of such specialised assistance. In the first place, it says that any staff working for it should be servants of Parliament and not of the Executive. Another important consideration is that there shall be no alteration in the general lines adopted by the Committee; that is, any change should not lead to interference in the working of the nationalised industries—a view with which we heartily agree.

A number of alternatives are put forward. The general preference is for any additional help to come from within the House of Commons, but it is left to the House to decide whether this, or the appointment of an "assessor" from outside, should be the course adopted.

* "Special Report from the Select Committee on Nationalised Industries (Reports and Accounts)," H.M. Stationery Office, 4s.

# Progress in Illuminating Engineering

## RECORD OF THE PAST HALF-CENTURY

By G. F. COLE*

**In this article the author outlines the tremendous advances in the art and science of lighting which have been made in the fifty years since the Illuminating Engineering Society was inaugurated**

THIS, the golden jubilee year of the Illuminating Engineering Society, seems to be an appropriate time at which to review the advances made in lighting, and the growth of interest in the subject, since the Society was founded in 1909.

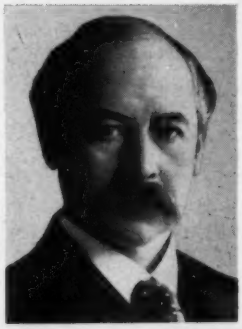
At that time the most widely used illuminant was gas. The introduction of the Welsbach mantle some twenty years previously had greatly increased the amount of light available for a given rate of consumption and although paraffin oil lamps were still quite common, especially in country districts, the convenience of the gas lamp made it very popular wherever a piped supply was available. The use of electricity for lighting was, however, rapidly gaining ground. The invention of the filament lamp had made available small units suitable for the home and other places where the arc lamp, for one reason or another, was not convenient. The efficiency of the carbon filament lamp was low and various attempts at improvement led finally to the tungsten filament vacuum lamp, with three times the efficiency, which was introduced in 1909.

As a result of these improvements in the means of light production it at last began to be possible to think of planning a lighting system, in the sense in which the term is used today, rather than of arranging a number of light sources in strategic positions to enable some activity or other to be carried on after nightfall. To illustrate the change it is interesting to compare recommendations for home lighting made in 1903, in Louis Bell's "The Art of Illumination," with some made in 1912 in a paper read before the I.E.S. For a reception room of average size Bell suggested that "an ornate gilt brass chandelier, carrying four 8-cp or 10-cp lamps or their equivalent should be ample," while for the bedroom "two 16-cp lights bearing upon the dressing table are regarded as sufficient." In 1912, however, the author of the paper wrote: "Pleasant household lighting is more a question of the proper distribution of the lights than of mere candle power . . . for purposes of reading, writing or needlework it is necessary to have at command a lighting value of 3 to 4 foot-candles. . . ."

### Foundation of the I.E.S.

It was at this period of rapid advance in both the efficiency and the convenience of means for the production of light that the Illuminating Engineering Society was founded. The moving spirit in the enterprise was a consultant, Leon Gaster, who in February, 1909, arranged a small meeting of twenty-six of those interested in lighting from different points of view. As a result of the support he then received the new Society was founded. Prof. Silvanus Thompson became the first president and the first technical meeting was held in the building of the Royal Society of Arts in November, 1909.

*Leon Gaster, founder of the I.E.S. and hon. secretary, 1909-1928*



*Professor Silvanus P. Thompson, the first president of the I.E.S.*

The title of the Society was chosen deliberately, for it was emphasised that there were as yet no illuminating engineers. Everyone interested in the subject of lighting was eligible for membership, whether his interest arose from the practice of his profession as engineer, architect or ophthalmologist, or whether it was due solely to a realisation of the important part lighting was beginning to play in the life of the community. Meetings were held monthly for the presentation and discussion of papers on lighting in different fields and gradually practice improved, early mistakes were corrected, and the basic principles of good lighting were established.

### Factory Lighting Committee

A milestone on the road to general recognition of the importance of the subject was reached at the beginning of 1913 when the Home Secretary appointed a Departmental Committee on Lighting in Factories and Workshops, five of the eight members and both secretaries being members of the I.E.S. This committee carried out a very thorough survey of industrial lighting conditions at that time and it is interesting to compare some of the values of illumination then observed with those prevalent in industry today. For instance, in spinning mills over 60 per cent of the measured values lay below 0·5 lm/ft², while even in weaving sheds half the recorded figures were below 2 lm/ft². Today it is common practice to

* Secretary, Illuminating Engineering Society.

*Modern factory lighting installation*

provide 10 lm/ft² for spinning and 30 lm/ft² for weaving, while much higher values are by no means uncommon.

Although when the Committee reported in 1915 its recommendations were very modest by modern standards, there is no doubt that the report had a considerable influence in improving lighting conditions generally. In spite of the fact that it was concerned primarily with industrial premises, it provided, by implication, authoritative support and weighty evidence for the desirability of good interior lighting everywhere.

## Exterior Lighting

From the time of its formation, the I.E.S. participated actively in efforts to improve exterior lighting conditions. In particular, it was strongly represented on the Joint Committee on Street Lighting set up by the I.E.E. early in 1911. This Committee reported in 1913 and it is worth noting that the minimum values of illumination laid down for the different classes of streets ranged from 0·01 to 0·1 lm/ft², measured at a height of 39in above the carriageway. Progress was arrested by the 1914-18 war, but in 1922 a meeting of the Society was devoted to the subject and soon afterwards a committee of the British Engineering Standards Association (now the British Standards Institution) under the chairmanship of Mr. (later Sir) Clifford C. Paterson and largely composed of members of the Society, was formed to prepare a standard specification. This was issued in 1927, but was found to be open to certain objections and a much revised document appeared in 1931. Just about this time discharge lamps, with their much higher efficiencies, began to make their appearance on the streets and simultaneously the validity of road surface illumination as a criterion in street lighting was being challenged.

In 1934 a most important step was taken when the Minister of Transport set up a Departmental Committee on Street Lighting. Its final report was issued in 1937 and the provisions were to a large extent based on the work that had been done (some of it at the instigation of the Committee itself) on the reflection characteristics of road surfaces and the principles of "silhouette vision" on the roadway at night.

Improvements on the lines of the 1937 report were quickly put in hand by a number of local authorities, but again war intervened to prevent further progress. The conclusion of hostilities was, however, the signal for widespread activity and since 1945 progress in street lighting in this country has been rapid and continuous. A Code of Practice, based on the 1937 report, has been published by the B.S.I. and the use of fluorescent lamps has grown rapidly since the first experimental installations were put up at the end of 1946.

Another aspect of exterior lighting for which a good deal of credit is due to the I.E.S. is the floodlighting of historic or otherwise noteworthy buildings. Taken very much for granted today, this enrichment of the night scene was but little practised before 1931. In that year the International Commission on Illumination (C.I.E.) held a plenary session in this country and to mark the occasion the Illuminating Engineering Society collaborated with the National Illumination Committee (the British constituent body of the Commission) in arranging a display of floodlighting on a quite unprecedented scale. Since that time floodlighting has come to be regarded as an indispensable feature of the celebrations on any occasion of local or national rejoicing.

The more utilitarian aspect of floodlighting must not be forgotten. While the lighting of quarries and open-air building sites for enabling work to be carried on at night has been practised for many years, its extensive use for sports lighting, now frequently on a grand scale, is a comparatively modern development.

## The I.E.S. Code

The aims of the Illuminating Engineering Society were well stated, in the constitution adopted in 1909, to be "the advancement of the theory and practice of illuminating

*Modern drawing office lighting installation*

engineering and the dissemination of knowledge relating thereto," and it was in pursuit of the second of these aims that the Society in 1936 published the first edition of what is now universally referred to as the "I.E.S. Code," although it then appeared in very modest form under the title "Recommended Values of Illumination." It was not until the fourth edition appeared in 1945 that the word "Code" was used to indicate that the document was no longer just an extensive table of values of illumination considered appropriate for various tasks. For the first time it contained an important section dealing with the "quality" of lighting as distinct from the quantitative aspect represented by the tables of previous editions. The fifth edition was published in 1949 and the sixth in 1955.

A comparison of the successive editions of the I.E.S. Code reveals unmistakably the remarkable developments that have taken place in interior lighting during the last twenty years, and more especially since 1949. The emphasis has been shifting continuously from the figure of illumination provided at the task to the other factors which so vitally affect the ease of seeing, particularly glare and the brightness contrasts in the visual field. It is interesting to notice that two of the early meetings of the Illuminating Engineering Society were devoted to a consideration of the subject of glare. Today it is still a matter for careful consideration by the illuminating engineer when designing a lighting scheme, and the desire to combine a high illumination on the working plane with freedom from glare has led to the development of the modern louvred fitting and the louvred ceiling.

## Research

Any sketch of the progress of illuminating engineering over the past 50 years would be incomplete without some reference to the research which has so greatly contributed to this progress. It was research that made possible the metal filament lamp and, at a later stage, produced the various types of discharge lamps, including the fluorescent lamp. Research on lamps, indeed, has been responsible for the remarkable fact that the efficiency attainable in light production today is from eight to ten times as great as it was when the Illuminating Engineering Society was founded. Side by side with this development there has been a vast volume of research on the most advantageous use of light, both in interiors and on the highway. In all this work members of the I.E.S. have made notable contributions and the Society has provided a channel of communication between the worker in the laboratory and the practitioner in the field.

What, it may be asked, are the most notable changes which have taken place during the last fifty years in the technology of lighting? One has just been mentioned, the remarkable increase in the efficiency of lamps, with a more than corresponding decrease in the actual cost of light owing to the lower cost of electrical power in terms of real values. The other is the far greater emphasis now placed on the manner in which light is used. These two are by no means unconnected. The low cost of light makes it economically possible to provide values of illumination which were practically unheard of in 1909. Further, good lighting can now be provided over the whole area of a room or a workshop, whereas formerly, if a high illumination was necessary for a particular task, it could be obtained only by the use of local lights and the surroundings, if not actually gloomy, at least appeared so by comparison.

In 1909 lighting was costly and great efforts were required to provide the bare minimum of illumination at those places where it was most needed. Between the wars the cost of light in relation to that of other commodities was falling and the levels of illumination customarily provided rose correspondingly, as the benefits obtained in this way became increasingly apparent. The emphasis, however, was still on the quantitative aspect of any lighting scheme. During the last two decades costs have fallen spectacularly and, concurrently with further increases in illumination values, much more attention has been paid to what may be called the amenity aspect of lighting. It is not, however, possible to separate this from the strictly utilitarian aspect. A well-lighted office or factory is a pleasanter place to work in but it has also been found that with good lighting productivity tends to rise and absenteeism to diminish. A tastefully lighted shop window improves the appearance of a street, but it also attracts custom. A well-lighted street may indeed be a source of civic pride, but it has been found that simultaneously the night-accident rate is diminished.

*Modern street lighting installation*

Recognition of such facts as these is now not confined to the illuminating engineer and the present widespread interest in lighting matters is probably the most remarkable of all the changes that have taken place in half a century of lighting practice. Further progress seems inevitable and to stimulate it and ensure that its benefits are as widely enjoyed as possible is the task of the Society whose motto is "To spread light everywhere."

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## Electric Motor Film

A COLOUR film with the title "Winding an Electric Motor" has recently been issued by the Brook Film Unit (Brook Motors, Ltd., Empress Works, Huddersfield). It is a 16 mm sound production with a running time of 9½ minutes, and has been made particularly for use in technical colleges and schools. The film gives a simple explanation of the basic functioning and winding of a normal three-phase motor.

With the aid of animated diagrams, the winding of a simplified wooden model is shown, followed by the winding and connections for a standard three-phase induction motor produced by normal commercial methods. Although it is intended for electrical students in technical colleges and schools it will also prove useful to companies who operate training schemes for their own electrical apprentices.

Also recently made available are two 35 mm filmstrips, "Installation and Maintenance of Electric Motors" and "Selecting the Right Motor." The former has 31 frames, the latter 26. The first contains useful tips for the maintenance engineer and visual instruction on dismantling, servicing and re-assembly. The other strip shows the variety of types and enclosures which are available for specific applications, together with pictures of actual installations showing the many types of modern electric motor in use. Commentaries are available in booklet form for each of the strips.

# Modern Works Lighting

By G. W. LEVEY*

**Lighting in works interiors is becoming increasingly important and while the design of all but the most simple installations is a job for the experienced lighting engineer, the user, who has to conform with statutory regulations and is responsible for maintenance, should appreciate the principal factors involved and be able to appraise the value of the advice given by the specialist. In this article the more important factors of design are discussed from the user's point of view**

WHEN filament lamps were the only popular electrical sources of light and these were installed in a more or less haphazard pattern to give spots of light in working areas, there was little choice of equipment and design presented few problems. The extensive use of comparatively high intensity general illumination and the variety of lamps, fittings, cables and other equipment now available has complicated the approach to lighting design, and the best result can only be obtained by carefully considering the requirements and problems of each part of each installation and then selecting the most suitable equipment and methods.

Particular attention is often given to the size and spacing of lamps and the type of lamp and reflector without any regard to how they are to be installed and maintained. The lighting installation should be considered in its widest sense including everything from the point of supply to the lamp. It is quite illogical to concentrate on the position and type of reflectors and lamps to provide even illumination of the proper intensity if the distribution system allows large voltage fluctuations or the design intensity cannot be maintained economically because fittings are not readily accessible for cleaning and relamping.

Costs for different systems can only be compared for a given installation as they depend on the quantity and quality of the illumination required, the type of buildings, the cost of electricity, the layout of the power system, the period of use and the ambient conditions; it is, however, convenient, after deciding the intensity of illumination, to select the most suitable type of lamp and "build" the system round it.

It is not possible to rely entirely on tables and other data because, although the physics of light is an exact science and light can be controlled within precise limits, the best method of applying the scientific principles varies with each job.

There is no "correct" illumination for a given task. The absolute minimum values for various tasks based on experiment and scientific investigation have been established but it is usually economical to exceed these.

## Intensity of Illumination

The eye can adapt itself, if given time, to a very wide range of illumination from 0·02 lumen/sq ft on a moonlit night to 3,000 lumens/sq ft on a summer day. There are, however, few people who can now work entirely in natural light and the question arises what intensity of artificial illumination to provide. Individual requirements vary; old employees need more light for a given task than the younger ones and prolonged tasks require more than short ones.

There is no practical limit to the intensity of illumination for any particular task; it should be as high as is economically possible, and it is obvious that, if an increase results in fewer accidents, less fatigue with better and higher production, it is worth while. The limit is reached when the cost of lighting balances any gain in production and this is always above the threshold of comfortable seeing.

The relation between illumination and visual acuity being sensibly logarithmic, extremely high intensities are not normally economic. They also introduce problems in the avoidance of glare and dissipation of the heat emitted.

The lighting must be suitable as well as sufficient. The eye sees by virtue of light reflected from the objects seen and distinguishes them from their surroundings by comparison, so that the distribution of the light and its spectral composition, in relation to the object, must suit the particular task.

The eye cannot adapt itself rapidly to changes in intensity, neither can it adjust itself to receive the correct amount of light from a high brightness source without reducing its ability to see objects of lower brightness; the intensity of illumination must, therefore, be comparatively constant (not flickering) and dark shadows and glaring light sources or reflection must be avoided.

The minimum value of illumination required must be based on experience; scientific investigations and accepted values for various tasks are given in the Illuminating Engineering Society's Code for the Lighting of Building Interiors.

## Importance of Lamp Characteristics

The approach to correct design is complicated by the fact that so many different types of lamp are now available and this makes it necessary to consider several factors before selecting the type of lamp to be used for a particular job. The initial cost, life and efficiency vary so much that a true comparison can only be made on a common lumen output basis. The spectral characteristics may also require consideration when colour rendering is important.

On the output basis the cost of lamps falls with an increase in size (exceptions are the 300 W tungsten filament and the 2,500 W mercury discharge lamps for which there is a small demand), but it is not always possible to take advantage of this because the building structure influences the spacing and therefore the size of lamp required for a given intensity of illumination, and the larger lamps are not desirable at low mounting heights when the brightness would cause glare.

The cost of electricity and long periods of use often justify the more expensive but more efficient lamps while, on the other hand, the call for good colour rendering can

* McLellan & Partners.

make the less efficient lamps necessary. The relative initial and running costs for a popular range of lamps is illustrated.

## Tungsten Filament Lamps

When the cost of electricity is low and the period of use short, tungsten filament lamps have much to recommend them. The light from the comparatively compact source is easily redirected by simple reflectors, no control gear is required, and the spectral composition of the light has almost become a standard for artificial lighting, being considered satisfactory for most tasks. Tungsten lamps are not as sensitive to voltage variations as the gaseous discharge types for although the light output falls with a reduction of voltage it does not fail entirely within the variation normally experienced; for this reason they form a useful back-up for discharge lamps, reducing the possibility of a total blackout.

The relatively short life of tungsten filament lamps means frequent changing, but when maintenance does not receive the attention it should, this becomes a good point because it at least ensures a clean lamp after about 1,000 hours of use; it is, however, a costly nuisance when lamps are not readily accessible or have to be changed out of normal working hours and when the need for a change does not coincide with the normal cleaning periods.

## Fluorescent Tubular Lamps

As an alternative to the lower wattage tungsten filament lamps fluorescent tubular lamps can be considered and the illustration shows that the higher cost is more than compensated by the increased efficiency after allowing for losses in control gear. These lamps also allow a choice of colour which should be selected when designing the installation, because of its effect on the intensity of illumination. A change from warm white to de-luxe warm white would, for instance, reduce the intensity of illumination by about 38 per cent.

The large luminous area and correspondingly lower brightness is an advantage in low premises, in fact bare tubes can be mounted less than 16ft above floor level without contravening Statutory Rule and Order 1941 No. 41, but this can lead to discomfort unless the background is bright enough to avoid undue contrast.

The " window " sector of tubes fitted with an integral reflector is much brighter, twice that of the normal tube, and these lamps should not, therefore, be mounted within the normal field of vision without side screens. These lamps cost more than the standard tubes but have the advantage that light on the working plane is not materially affected by dust collecting on the top of the lamp; thus the rate of depreciation and cleaning costs are lower.

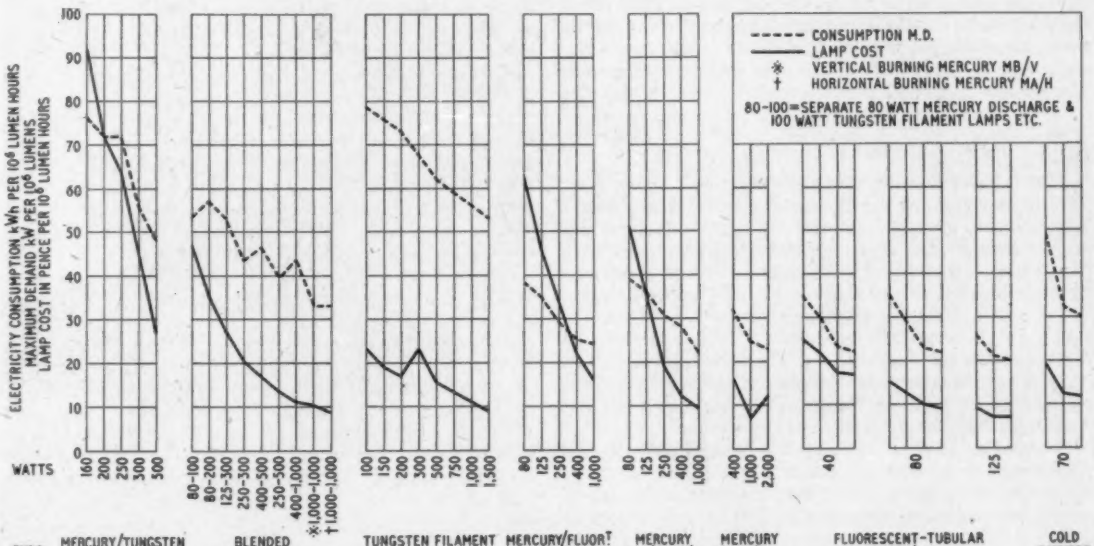
The effect of control gear losses on running costs is taken into account in the figure; the cost of the control gear itself increases the overall cost and is reflected in higher capital charges which can make the use of fluorescent tubular lamps uneconomical in places where the period of use is short, electricity costs low and the quality of light unimportant.

## Mercury Discharge Lamps

It is evident from the figure that lamp cost varies widely over the range available and that the smaller lamps cannot compete with fluorescent tubular lamps except where a compact light source in a simple fitting is desirable. The electricity consumption for a given light output is much lower than for tungsten filament lamps but, as with fluorescent tubular lamps, the overall running cost is affected by the cost of control gear which makes them uneconomical unless the period of use is long enough to compensate for the additional capital charges.

The blue-green light of the mercury discharge is not always acceptable but, when the deficiency in red light is compensated for by incorporating a fluorescent bulb, the light becomes suitable for work where precise colour discrimination is not required. The fluorescent bulb increases the efficiency of the larger lamps but not enough to balance the higher cost so that the improved colour is costly; the electricity consumption of this type of lamp is, however, lower than that of tungsten filament, blended lamps or a combination of mercury discharge and tungsten filament lamps.

The light from mercury discharge lamps can also be improved by blending it with that from tungsten filament




*Relative cost of lamps and electricity consumed on common basis*

lamps. The proportion of light from each lamp is not critical and satisfactory results have been obtained with approximately equal watts or equal lumens. The running cost is lowered by keeping the tungsten component down, but much depends on the relative importance of running cost and colour discrimination.

This combination of lamps is particularly suitable for large areas in high buildings when the tungsten component improves the colour of light and averts the danger of a complete blackout should the mercury lamps be extinguished by a momentary interruption or reduction in voltage by a surge on the electricity system.

Blended light can also be obtained from a single lamp; the mercury tube being combined in one outer bulb with a tungsten filament which acts as a ballast. This reduces the capital cost, because no control gear and only one reflector is required, but these lamps are available only in the smaller sizes, they need a deeper and therefore less efficient reflector and both lamp cost and electricity consumption are higher. Where the smaller sizes are necessary it is generally better to obtain colour correction by using either bulbous or tubular fluorescent lamps.

## Cold Cathode Lamps

The very high initial cost and fairly high running costs of cold cathode lamps exclude them from most installations unless very diffuse lighting is essential to the process. They have the advantage of a very long life which may be important when the lamps are not easily accessible but is relatively unimportant where lamps have to be cleaned frequently because they can be changed at the same time; lamp changing and cleaning costs can then be reduced by using fewer lamps of higher intensity.

## Fittings

Bare lamps are seldom satisfactory or desirable and fittings are therefore required to redirect light (which would otherwise be wasted) into the working area, to screen high intensity light sources from normal view and, in certain circumstances, to protect the lamps from mechanical damage, water, atmospheric pollution or, in special areas, to isolate them from explosive atmospheres.

The satisfactory operation of the lighting installation in a works depends much on the lighting fittings; types should be selected which not only give the desired results when installed but continue to do so under operating conditions throughout their life with minimum attention. The design of fittings can also materially affect the cost of cleaning and lamp replacement.

## Importance of Reflector Surface

When fittings are mounted less than 16ft above floor level in working areas it is compulsory to screen bright light sources with a fitting having a cut-off angle not greater than 70 deg from the perpendicular which means that a large proportion of the light has to be redirected by the reflector. For example, about 85 per cent of the light from vertical burning mercury discharge lamps in such fittings falls on the reflector. It is sometimes considered desirable to give more comfortable conditions, at a lower efficiency, by increasing the depth of the reflector to give a cut-off angle of 60 deg; the reflecting surface then assumes even greater importance.

A smaller amount of light is transmitted via the reflector from horizontal tubular lamps; the efficiency of fittings for these lamps is not therefore quite so dependent on the condition of the reflector. The proportion of reflected light, however, remains large and it is evident that all reflectors should be designed to keep clean as long as possible and to be easy to clean when this becomes necessary. In some circumstances the rate of depreciation can be reduced by totally enclosing the lamps, or using fittings designed with open tops so that the through draught caused by the heat of the lamp carries the dust away from the reflector surface.

## Working Temperature

It is important that the temperature of the terminals for the connection of circuit wiring should not exceed the maximum allowed for the type of cable to be used and this can seldom be achieved by connecting rubber insulated cables to the lampholder. Many fittings, particularly those designed for suspension, are fitted with heat baffles and other devices to reduce the temperature to the desired value, but the precaution is not always taken with smaller fittings including the totally enclosed bulkhead type. These fittings can be troublesome when rubber insulated or similar cables are placed inside the enclosure because temperatures over 170 deg F are possible. For this reason, it is bad practice to run cables through the fitting to the next point—as is sometimes done. Heat-resisting connections should form part of the fitting, but in their absence the wiring should be terminated with tails or protected by sleeving.

The comparatively low temperature of fittings for tubular fluorescent lamps has created a problem in some shops where oily vapour has condensed on the fittings and dripped on to the operators. The nuisance has been dealt with in the correct way—tackling not the effect but the cause—by reducing the contamination of the air and so improving working conditions in all respects.

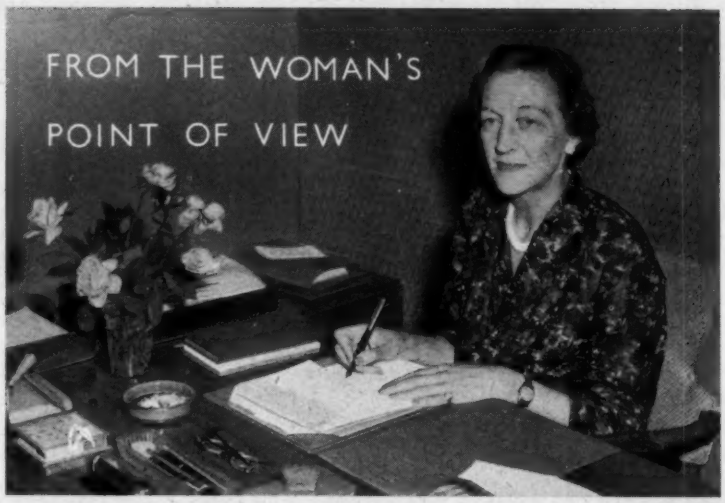
## Maintenance

All parts of a lighting installation must receive regular attention throughout their life if their efficiency is to be maintained and it must be possible to give this attention safely and economically. To achieve this, any special requirements must be studied, and the particular problems resolved during the design period and this must be followed by a planned maintenance system; spasmodic maintenance is unsatisfactory and in the long run costly.

Means of access is covered by the Electricity (Factories Act) Special Regulation No. 25 which reads:—"Adequate working space and means of access, free from danger, shall be provided for all apparatus that has to be worked or attended to by any person." Safe access to lights is specifically mentioned in the explanatory memorandum to Regulation No. 26: "Access to lights for renewal or other purposes should be free from danger." If lighting fittings, and their associated apparatus such as controls and fuseboards, are to be maintained during working hours they should not be placed over or near any hazards such as unprotected live conductors or unguarded moving parts or machines. Reflectors require periodic cleaning and lamps have to be replaced or cleaned. As tungsten filament lamps, burning continuously, have to be replaced at least eight times in a year, the importance of ready and safe access will be appreciated.

The maintenance programme for fuseboards, contactors and similar equipment should follow the same pattern as planned for the power installation. The frequency of cleaning these can be reduced by providing dust-tight enclosures and ensuring that covers are kept closed. The economical interval for lamp and reflector cleaning depends on the rate of depreciation, the value of the light lost and the cost of cleaning. These items can be estimated for the first year during which records can be kept to establish actual values. The cost of the useful light is lowest when the cost of cleaning balances the cost of the light wasted by depreciation in the interval.

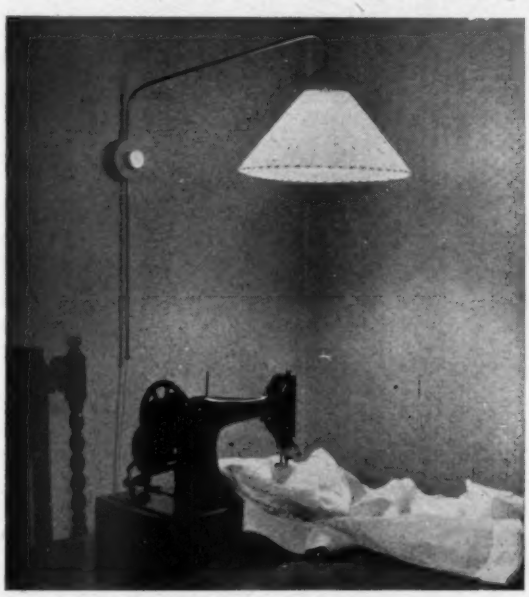
# Lighting




By
**MARY GEORGE, M.B.E.**
Director of the Electrical
Association for Women

**Although lighting was the first general application of electricity in the home, it is the field in which the greatest improvements could be made in most homes today. Why as a nation are we still so lacking in light consciousness? This cannot be due to lack of imagination in the design of fittings or to any faults in the performance of lamps: the many excellent fittings and the variety of reliable lamps which are available prove the contrary**

WHILE the mediocrity of the lighting in most homes is caused by many factors, perhaps the most obvious is the lack of appreciation of the need to include a plan for light in the scheme for household equipment. A house must have light just as it must have a water supply, and often the two services are put on the same level. A water rate must be paid and so must the lighting bill, but beyond that thought does not go, unless it is to install the fancy fitting that has caught the eye of a member of the family, or the table or standard lamp which was on someone's "gift list." In neither case is much attention paid to an integrated lighting scheme. Lighting remains a utilitarian necessity to be kept to the minimum or, if decoration is attempted, it is of the patchwork or "appliqué" variety. There is a great need for space lighting to be considered in the same way as space heating. Today whole-house heating is accepted as a practical ideal, but there is a long way to go before overall lighting of a high standard is generally accepted.



*Single adjustable diffused light for a dark corner*

A second reason for inadequate lighting is cost. The "Planning for Light" campaign which the E.A.W. undertook a few years ago revealed how many housewives were deterred from having really good lighting by an ill-founded fear of cost. This may be a "hang-over" from the war, when every watt counted in the fuel economy effort, or it may even stem from the pre-war days when many households had only a flat rate tariff, and lighting tended to seem expensive compared with some other services. In most families the household budget is distributed on a somewhat illogical basis. What would appear to be a disproportionate sum is spent on one item or service at the expense of some others, but rarely does the disproportion favour lighting. One E.A.W. member, a director of an electrical contracting firm, stated that housewives in general were willing to spend far more money on curtains and carpets than on lighting and fittings. Yet the report revealed that many members felt that well-chosen lighting could greatly enhance curtains and carpets, and that it could also play down a certain amount of shabbiness in a much-used home.

A third reason for indifferent or unsuitable lighting is that the housewife finds it difficult to obtain advice pre-

*Bay of bedroom with lamp in washable silk shade flush to the ceiling. The dressing table is adequately served by reflection from the mirror*

sented to her in such a way that she can relate the technicalities and æsthetic details of lighting to her own home. The E.A.W. report showed very strongly that women want more information on the respective merits of fluorescent and filament lighting, on the different kinds of lamps for both types of lighting, and on their uses for specific purposes in the home. They want individual guidance on the choice of fittings and on placing them in the home in relation to the general household needs and to the needs of individuals. These individual needs may be occasioned by the performance of special tasks or may result from physical disability or advanced age. Those women who have given thought to home lighting and who have found out the " snags " for themselves have asked for early consultation between prospective owners of houses, architects, builders and contractors, so that the lighting scheme may be planned at an early stage and may then be considered in conjunction with the main decorative scheme, and again whenever redecoration is undertaken or repairs made.

Women generally know the effect they want to create in their homes, but they would welcome more detailed advice on the means to obtain it. That they know what they like when they see it in its right context is a fact applicable to most household equipment, but it is doubly applicable to lighting. For the lay person, however, it is very difficult to have a complete lighting scheme in the mind's eye.

As in most spheres indifference is a contributing factor to poor lighting. We have for so long become accustomed to low levels of lighting, to contorting ourselves instead of using an adjustable fitting or having two well-placed fittings, to peering, treading very carefully in dark passages, or just taking a risk, that we do not realise the great advantages to be gained by a little planning and a relatively small financial outlay. Lighting education is needed, but in a novel yet practical way, to induce interest in a subject about which most people think they know all there is to know until they come to buy.

Some women have given as their reason for inadequate lighting a fear of upheaval in the home during and after the installation of new wiring and fittings. This suggests that there is scope for simple advice on the possibilities of surface wiring. It also emphasises the importance of adequate wiring at the outset in a new home, and in the rewiring of an old one. Obviously, when there is one central light point and only one or two other points in a general living room, the need for an additional light source will be sacrificed to the radio, television set, electric fire and iron.

The usual shortcomings in domestic lighting are low wattage; light in one place only to serve a multitude of purposes, the light usually coming from one ceiling fitting; wrong placing of lights though the total lighting intensity may be sufficient; wrong choice of fitting; shades of the wrong texture, shape and colour, and sometimes dirty shades; lack of enterprise in choosing a new scheme, or even in considering fluorescent lighting.

It is significant that there is a growing public consciousness that one central light is usually not enough for a family room, a kitchen, or bedroom, and adjustable fittings are becoming more widely used. It can also be said that as a result of the E.A.W. lighting campaign many members stated that among the changes they had made in their own homes was the installation of fluorescent lighting in other parts of the house as well as in the kitchen. There is, however, need to combat the prejudice among women against fluorescent lighting, which is usually based on their knowledge of the early " daylight " fittings; they are often unaware that fluorescent and filament lighting can be happily combined in one room and in one fitting.

There are two well-defined stages in improving home lighting, which might appear in the housewife's notebook as " Choosing " and " Using." When they are considered in this order, problems often arise once the scheme is settled or the new fitting bought. Therefore, the wise housewife will first consider the uses required of her home lighting before she starts to choose.

All women want their homes to have a welcoming appearance, with individual attractions which will invite the interest of visitors and give permanent satisfaction to the family. Lighting makes a contribution to the general pleasing effect of the home, while enhancing the beauties of furnishings, wallpapers, paints and pictures. It should create a relaxing though not a soporific atmosphere, and the depressing effect of over-subdued and wrongly used indirect lighting should be avoided.

The first use of lighting in the home is, of course, to enable people to see where they are going and what they are doing, and there are many ways of meeting these simple requirements. This brings in the important factor of home safety. There is the question of ensuring safety of life and limb through the proper lighting of stairs, landings, cellars, back doors and garages, the use of two-way switches, and the placing of portable lights in safe positions to avoid long flexes and the possibility of persons or animals knocking over the lamps. There is also the less-considered question of the effect of lighting upon health, since the wrong placing of lights may contribute towards bad posture, and too low wattage or over-bright unshaded lights may cause eyestrain.

What her family may be doing under artificial light and where they will be doing it will suggest to the housewife a number of points to be considered. Round the dining table they will certainly want to see each other, their visitors, and their plates in a pleasant, clear light, and the " up and down " ceiling fitting has made quite a contribution in this respect. For family television viewing some local lighting should be provided near the screen. The close work in which various members of the family may be engaged in living room, bedroom, study

or workroom should also be properly illuminated by fixed local lighting or portable lighting.

In most rooms there are many varied activities; when one light is required to light everything, it rarely lights anything well. The housewife therefore has to consider the merits of general and local lighting, and the advantages of the two-in-one-purpose fittings against those of two separate fittings.

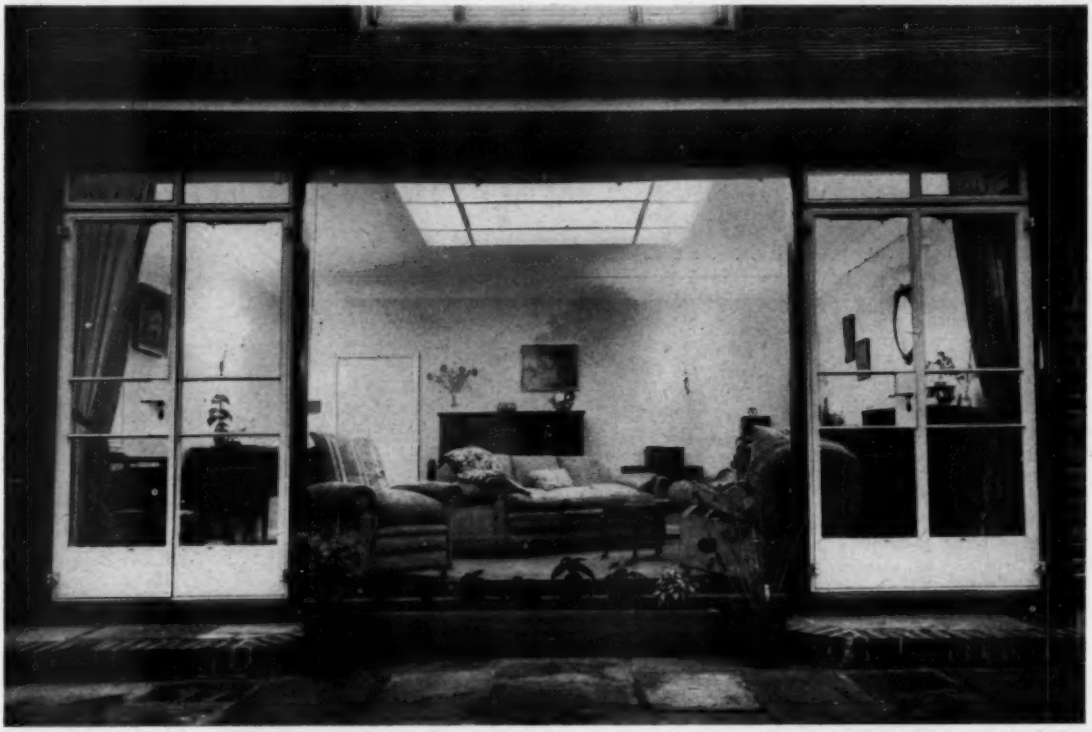
The housewife must also decide whether a measure of indirect lighting will be acceptable to her family and, if so, real thought and advice is needed in order to get the maximum benefit from the light output, while ensuring that the fitting remains unobtrusive. Women most probably fall into two groups—those who prefer a general illumination from a hidden source, and those who take pleasure in seeing a beautiful fitting which they have carefully chosen for its colour, shape and material. A plea may be made for controlled lighting throughout a room as for theatre lighting. While it is possible to vary the general lighting intensity in a room by switching individual lights on and off, there would be value in having a general illumination control on the "high," "low" and "medium" basis of the heater or cooker switch.

The size and shape of a room and the space available will play a large part in determining the type of lighting, since a particular fitting which will look well in one room may be unsuitable in another. Sloping ceilings, recesses, bookshelves and cupboards all claim special attention, because they affect the reflectivity of the light installed, and in themselves can be a decorative feature. Pelmet and mirror lighting should also be considered.

Whenever she is choosing anything for the home the housewife thinks of cleaning and maintenance. Fittings must not be dust collectors, and they must be easy to clean. Here much has been offered to the modern home by the wide range of new materials for fittings and shades. The use of metal and of plastic in its many forms has also made for lightness, which is an advantage at spring cleaning time. It should also be easy to replace a lamp in any fitting without having to call upon the services of the member of the family with the smallest hands, the most dexterous fingers or the longest arms, bearing in mind that lamp replacement is usually carried out from the precarious position of a step-ladder or a chair.

The fairly recent introduction by the lighting industry of the smaller "mushroom" shaped lamp with the same wattage as the larger bulb of traditional shape has been welcomed in many households where it has enabled higher intensities to be obtained from smaller fittings. Makers and purchasers of shades should bear in mind that shades for 100 W or 150 W lamps should be sufficiently wide so that they are not affected by the heat from these lamps. Many shoppers would also welcome greater opportunities to buy a particular shade in different sizes.

Having made a list of family needs, circumstances resulting from the structure of her house or flat, technical and æsthetic considerations, and price restrictions, and having acquired a mental picture of what she has seen in someone else's home or in the pages of her favourite magazine, the housewife sets out to make a choice which will satisfy all these requirements. This is where her path needs to be a little easier. If she enters a lighting showroom with every conceivable type of lighting fitting hanging around she is bewildered and finds it difficult to select upon the principles she has drawn up for herself. She would welcome a small cubicle for choosing her own lighting fitting away from competition with the hundreds of others, in the same way as she can hear a gramophone record in a small soundproof booth before buying it.



*Lounge with diffused ceiling lighting and wall brackets. (There are six switches at the door)*

*Kitchen lighting exemplified in the E.A.W. Demonstration Room*

She would also welcome the opportunity of seeing the fitting against coloured screens to judge its effect on fabrics and paints similar to those in her home. We all know how difficult it is to select paint or fabrics from a small sample away from the place where they will be used, and the same thing applies, though more strongly, when choosing a lighting fitting or a lighting scheme. It is like choosing a hat without reference to the outfit with which it is to be worn.

The cubicle should have socket outlets to enable the buyer to see the effect of both ceiling and wall fittings, and thus to assess them in relation to the room for which they are destined. It might also be possible for the lighting showroom setting to resemble the home even more closely if space could be devoted to a mock living room, bedroom, or kitchen. Scale models of rooms would be a useful means of illustrating the effects of placing lights in various positions, although the lighting would have to be miniature and might prove too costly.

Most of the fittings in lighting showrooms tend to fall into two categories, the somewhat old-fashioned and the ultra-modern, and as the public usually gets what it asks for, this reflects to a great extent the general demand. As I mentioned earlier, the manufacturers are not lacking in imagination or in the variety of lighting they offer for the home, but there is a great need to extend knowledge among the public of how to select the most pleasing and most effective lighting for individual homes.

The newer types of standard lamp are welcomed, with their slender poles and light head which is adjustable up and down and sideways. Luminous panels of light are, too, an attractive and effective lighting feature for kitchens, halls, and even for some living rooms. Fluorescent or filament lights behind a " Perspex " panel create a " cloud of light," and in the United States the " cloud " is often of the same shape and size as the rug over which it " hovers " by suspension from the ceiling, or it can be installed flat against the ceiling. This does away with what an American lighting manual describes as " dead areas," and helps the home lighting to approximate more to what it should be—a creation indoors after dark of natural daylight conditions with the elimination of shadows where they impede work but with the right use of light and shade to avoid a monotonous effect.

In this same lighting manual I was struck by the two dominating slogans " What to Use " and " Where to Place." It is with these two questions in mind that the British housewife sets out to improve her home lighting, and in the American book her transatlantic sister is given " 28 room colour schemes " and " 35 methods for lighting your home." This may perhaps err on the side of complexity of choice, but at least it shows that thought has been given to presenting home lighting as part of the whole structural and decorative scheme of the house and helping the woman to choose with ease and advantage.

# INSULATION FOR SMALL TRANSFORMERS

THE Electrical Research Association has published a handbook, " Insulation for Small Transformers," by J. H. Mason and C. G. Garton, which provides guidance and data for designers of all forms of electrical insulation, and will be useful for assessing the applications of new materials, and the insulation requirements for onerous or unusual service conditions. Factors which affect the electric strength and the life of insulation in service are considered in some detail. Numerous graphs are provided showing the variation of discharge inception stress with the thickness and permittivity of insulation, both for surface discharges and for internal discharges in cavities of varying thickness. Mechanisms of breakdown by discharges in "solid" and in oil-impregnated paper insulation are described and graphs and tables illustrate the relative resistance to breakdown by discharges or surface tracking in some twenty different sheet and moulded insulating materials. The effects of varying the temperature and the insulation thickness are considered.

The electrical, thermal and mechanical properties of wire coverings, paper and fabric sheet insulation and laminates are presented in tabular form, and the merits of impregnation with oil, varnishes and casting resins discussed. The importance of complete dryness and of effective impregnation are emphasised. The virtues and significance of non-destructive tests, such as discharge detection and measurements of insulation resistance, loss angle and dispersion are compared with the customary overvoltage tests, which often give little assurance of satisfactory life in service. Although largely based on experience at the Electrical Research Association, this pocket-size book presents data from many other sources, and 136 references are given.

The handbook (Report Ref. L/T381) is obtainable from the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey, price 37s 6d plus postage.

## Faraday Lecture

The Faraday Lecture of the Institution of Electrical Engineers will be given during the forthcoming session of the Institution in London and at the various provincial Centres by Professor M. G. Say, and the title is " Electrical Machines." The lecture will first be given at St. Andrew's Hall, Glasgow, on 25th November. The London lecture will be on 17th February at the Central Hall, Westminster.

American Bar at the Great Western Royal Hotel, Paddington, London.

*Photograph by courtesy British Transport Hotels.*

Reception room of the Export Division of the British Motor Corporation at Holland Park Hall, London.

*Electrical Review photograph.*

Entrance hall to office block at the Radiochemical Centre of the United Kingdom Atomic Energy Authority at Amersham.

*Photograph by courtesy U.K.A.E.A.*

*Electrical Review photograph.*

Office of the Director of the Electrical Association for Women at the Association's headquarters in London.

*Photograph by courtesy U.K.A.E.A.*

Control room of the steam turbo-alternator plant at the Calder Hall nuclear power station.

Motor room at the Brimsworth steel mill of Steel, Peech & Tozer, Rotherham.
*Photograph by courtesy The English Electric Co., Ltd.*

Part of the showroom at the London Electricity Board's premises, Finchley Road, London.

*Electrical Review photograph.*

*Photograph by courtesy Falk, Stadelmann & Co., Ltd.*

Special ward at the Royal Masonic Hospital in West London.

# VIEWS on the NEWS

*By REFLECTOR*

SOCIETIES of engineers of many and varied classes have arisen in recent years no doubt as a result of the trend towards somewhat narrow specialisation. Now I hear of a Society of Environmental Engineers. Without an explanation—which I am coming to—one would imagine this to be a body of engineer-ecologists. (Ecology is the study of living organisms' habits, modes of life, and relations to their surroundings.) But it is not quite like that—its object is "the exchange of information and views among those engineers who are concerned with the development of equipment to withstand shock, vibration and other forms of environmental conditions." I am a bit doubtful about the propriety of their adjective, but I realise the difficulty of adopting the term "Shock Engineers," or even "Vibrational Engineers."

* * *

Some time ago I recorded the insistence of miners and their wives upon the installation of electricity in their houses in the North East Coast area. It seemed that they (very wisely) preferred electricity to coal for cooking and heating. Things are otherwise at Broomhead and Methilhaven, Dunfermline, where the Fife Health Committee has decided to install solid-fuel appliances instead of electricity in two old folks' homes. In making this decision the Committee went against the advice of the county architect who recommended the installation of electricity. The *Evening Telegraph and Post* (Dundee) says that the installation costs were £4,600 for electricity, £11,500 for solid fuel and £12,000 for oil; the estimated running costs were respectively £1,767, £1,688 and £1,776. Two miners spoke in favour of solid fuel: one said that he thought the Committee should "vote for solid fuel as a gesture of faith in the industry" and the other said that it would be "a vote of assurance in the miners and to show that coal still had a place in the country." I may point out I think that coal still has a pretty large place in electric power stations.

* * *

I believe that it is quite common for women to disconnect their electrical appliances by pulling the connector off instead of withdrawing the plug. As the connector contacts are generally well shielded it is not often that there is trouble. Nevertheless, it is too easy in such cases for small children to push their fingers or pieces of metal into the entry and, as was shown at a recent inquest at West Bromwich, to receive a fatal shock. In this instance the lead to a percolator was taken from a two-way adaptor which also served a refrigerator and the connector was always "live." In many of the smaller appliances nowadays, particularly irons, the connections are permanent and concealed within the body of the appliance. As this means extra expense because it calls for a separate flex and plug for each item of equipment, this arrangement may not be popular but it is a very desirable one. I wish, however, that manufacturers of these appliances would not make it so difficult to renew flexes. Too often the wires are crammed into a very small space and it takes too much time and patience to get them round the terminal studs and under the retaining nuts and washers.

* * *

Another case of a fatal shock on derelict property has occurred, this time in the Edinburgh district. A demolition worker engaged in knocking down an abandoned factory pulled a fuse box out of a wall, took hold of the cable and was killed. An official of the South of Scotland Electricity Board who was called to the premises said that normally when a building was being demolished the Board was asked to cut off the supply, but there was no notification in this case. I should have thought that a building of this kind would have gone out of use some time before demolition was started and that the fact would have been discovered when meter reading time came round.

* * *

Light without heat has been the aim of lamp makers and lighting engineers ever since electricity was introduced as a means of illumination. In fact the glow-worm has been the exemplar. With this in mind I was surprised to see in the American *Electrical World* a picture of a most elaborate lighting installation with the caption:—"Cleveland Supermarket has 125 ft-c of excellent lighting which also provides 80 per cent of the heat." Presumably in warm weather the air conditioning arrangements have to be speeded up—hardly an economic system.

* * *

Improvements in machinery and methods are frequently opposed by employees in the businesses affected because of the possibility of redundancy (a neologism for "the sack"). One can sympathise with this attitude without approving it and hope that displaced men and women will be found some other work or be adequately compensated. There was recently a threat of trouble because the North of Scotland Hydro-Electric Board is trying out a scheme which would reduce the frequency of meter reading. According to newspaper reports, thirteen meter readers went on strike but upon receiving assurances returned to duty. It was much the same in other times and other climes. The *Electrical Review* of 15th September, 1899, published the following note:—

> "An American exchange says it is reported that the 'punkah pullers' in West Borneo are in revolt because the Rajah of Koti has bought $30,000 worth of electric fans, and the coolies who formerly worked fans, or punkahs, by hand, will now be out of a job."

# PUBLIC LIGHTING ENGINEERS

## Conference and Exhibition at Aberdeen

**The importance of finding a satisfactory compromise between lighting efficiency and æsthetic requirements was stressed by Mr. Ronald Parker in his presidential address. The Conference exhibition covers not only lamps, standards and control gear but also lighting towers and mobile erection equipment**

THE annual conference of the Association of Public Lighting Engineers which has been held this week in the Music Hall, Aberdeen, was opened on Tuesday morning by the Lord Provost (Mr. George Stephen). The conference has been attended by over 1,000 members of the Association and delegates representing some 320 local authorities throughout the British Isles, the fifteen Electricity and Gas Boards and manufacturers of street lighting equipment. There have also been a number of visitors from overseas.

At the four main conference sessions papers have been delivered on craftsmanship in public lighting, on fifty years of public lighting, on the practical aspects of column and lantern erection and on a planner's view of public lighting. An account of these papers and of the discussions will be published next week. There has been the usual display of street lighting equipment and apparatus in the conference building where delegates have had the opportunity of studying a wide variety of recent developments displayed by some twenty manufacturers. The outdoor exhibition of about 100 lamp columns was held at the rear of the building and the display of mobile equipment in North Silver Street.

### Presidential Address

Following the official opening of the conference, Mr. Ronald Parker, superintendent of lighting for the City of Aberdeen, was inducted as president for the current year. In his address Mr. Parker made a plea for a more liberal approach when planning lighting schemes for streets much used by pedestrians, or which were of historical or architectural interest. He agreed with the view that a too-rigid adherence to the British Standard Codes of Practice was undesirable and would lead to monotony. It was particularly important for lighting engineers to remember that the greatest use of such places was during the day and that it was too easy to spoil their appearance by day in an effort to make them safe at night. Where lamp columns, which were sited to give the maximum lighting effect, would be an eyesore in daylight, lighting engineers should examine all possible alternatives and be prepared to sacrifice to good appearance some efficiency of lighting. How far they could go in this way was a matter for individual judgment, a judgment that must be developed by experiment and experience. There could be no doubt, Mr. Parker continued, that in their preoccupation with the ever-pressing need to provide the maximum of good lighting in the cheapest way, they had tended to neglect the study of æsthetic needs. He hoped that more lighting engineers would come to recognise this as an important public requirement.

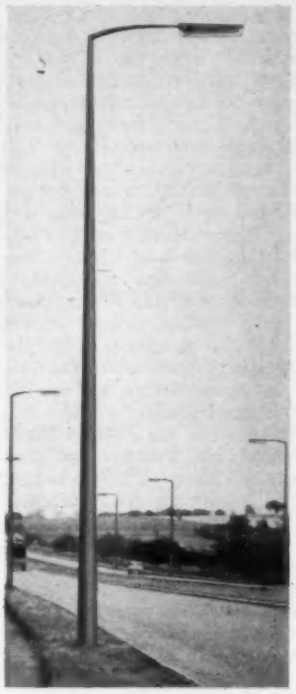
*Mr. R. Parker*

Mr. Parker expressed his regret that so little attention had been paid to equipment for streets other than traffic routes. It was on these streets that uninteresting installations were most frequently to be found, yet they offered the greatest opportunity for avoiding monotony because excellent visibility for drivers was not so important. The apparatus offered by manufacturers for these streets was very limited in variety, was usually purely utilitarian and any design out of the ordinary was relatively expensive. Manufacturers had not shown the same initiative in designing and selling Group B equipment as they had with Group A equipment, to which greater prestige was attached. But Mr. Parker considered lighting engineers were far from blameless and if they were more imaginative in their own approach to the design of Group B installations, manufacturers would produce suitable equipment.

It was of paramount importance, Mr. Parker emphasised in conclusion, that there should be an acceleration in the provision of adequate lighting on main traffic routes. To secure this they must press for the speedy removal of existing administrative and financial deterrents. But their ability to exert the maximum pressure to this end depended to a large extent on their progress as an Association. Membership must be increased to bring in all those directly concerned with the practical task of providing and maintaining the lighting on the roads, and there was also a special need to ensure a continuous supply of properly trained engineers. The extension of training and membership were very necessary if the Association was to reach the final peak of recognition by the grant of a Royal Charter.

### Exhibition

"The shape of things to come" in two types of street lighting—on major traffic routes and in residential areas—was the theme of the exhibit of the British Electrical Development Association. The provision of the higher levels of lighting demanded by the increased traffic on main roads was first illustrated by reference to the experimental lighting scheme on the dual carriageway at Baillieston in Scotland, where 280 W sodium lamps are mounted on 35ft columns. A film taken from a car moving along the road in daylight and at night showed the effectiveness of the installation. A second display described the experimental installation on the Coventry By-Pass where 35ft columns are also used, but this time with lanterns fitted with either one or two 200 W sodium lamps. Both displays emphasised how the simplified siting of lanterns,



*Experimental installation on Coventry By-Pass of 35ft "Adastra Curlew" columns with Siemens sodium lanterns (Poles, Ltd.)*

*Stanton No. 11 pre-stressed spun concrete lighting column with Siemens "Carpenter" lantern*

made possible by high mounting, clearly shows the run of the road ahead, and how the reduction in the number of columns used reduces the probability of vehicle-column collisions. The example set by the new towns has led to an improvement in the standard of Group B lighting in other areas. On another part of their stand the E.D.A. showed, by means of photographs and equipment, what can be done to provide residential areas with efficient modern lighting.

In addition to lanterns, columns and control gear from their standard range, the Revo Electric Co., Ltd., showed several new designs. Among them were a range of Group B lanterns for top or side entry mounting, suitable for 100/150/200 W tungsten or 50/80/125 W colour-corrected mercury vapour lamps. The lantern may be of the open or enclosed type and light control is obtained by means of a dome or bowl refractor. The body is of die-cast aluminium and incorporates a ventilated easy wiring compartment. The "Halcyon" lantern has a fibreglass canopy and "Perspex" bowl and accommodates two, three or four 5ft 80 W fluorescent tubes. The "Hyperion" lantern is designed for one 943 mm 280 W or two 140 W integral sodium lamps, and has a canopy of cast aluminium and a "Perspex" refractor.

The 200 W linear sodium lamp and "Amberline" lantern formed the principal exhibit on the stand of the A.E.I. Lamp & Lighting Co., Ltd. This lamp is claimed to be the first practical light source in the world to achieve an efficiency of 100 lumens per watt. Its ease of control and reliability under extreme climatic conditions make it inherently suitable for street lighting. The "Amberline" lantern is intended primarily for Group A roads and provides a non-cut-off medium-angle beam. It may be mounted at heights between 25 and 35ft and the columns spaced up to 200ft. The lantern consists of an integral canopy and bowl of grey and clear "Perspex," a main casting of silicon aluminium, containing a spigot entry and carrying the lamp support, and a die-cast aluminium cover plate, which gives access to the inside of the fitting from the rear. Light control is by refractor plates sealed on the inside of the bowl. A distinctive feature of the stand was the "Leader 15" aluminium column with the "Ashby" lantern. A new fluorescent unit for Group B roads, the "Residential" Mark II, a side entry reflector pattern lantern for two 2ft, 40 W tubes, was also shown.

Siemens Edison Swan, Ltd., also gave prominence to the new linear sodium lamp and to the lanterns in which it may be used. One of these—the "Coventry Osprey"—encloses one 200 W, 3ft lamp and provides an output of 20,000 lumens. It is available in single- or twin-arm units. An alternative design of Group A lantern—the "Coventry Oline"—accommodates one or two linear sodium lamps and, using reflectors or refractors, allows a lighting output of either 20,000 or 40,000 lumens at a mounting height of 25 to 35ft with 150ft spacing.

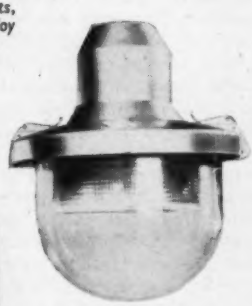
For Group B lighting the company showed their new "Sieray Minor" lantern which is available in open and closed versions, for 60/200 W, g.l.s. lamps, 80/125 W m.v. lamps, type MB/U or colour-corrected MBF/U. There was also a display of gas lantern conversion kits.

Steel columns which provide the extra mounting height required by the new high-output sodium lamps were shown by Poles, Ltd., and included an "Adastra" arc-type column and a "Curlew" column. Of particular interest was the "Concord" column—a circular pole of slim clean outline with a neatly fitted door giving access to the interior. There were also examples of the latest one-piece columns for Group B applications and an "Adastra" floodlighting tower.

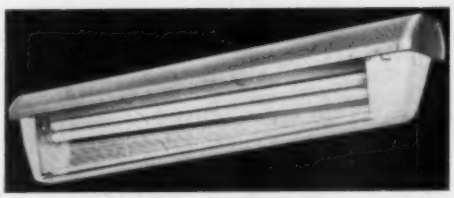
A standard floodlighting tower and "Tripole" tower were shown by Tubewrights, Ltd. The first is triangular

*Left: Metal Developments, Ltd., tapered aluminium alloy Class B lighting column*

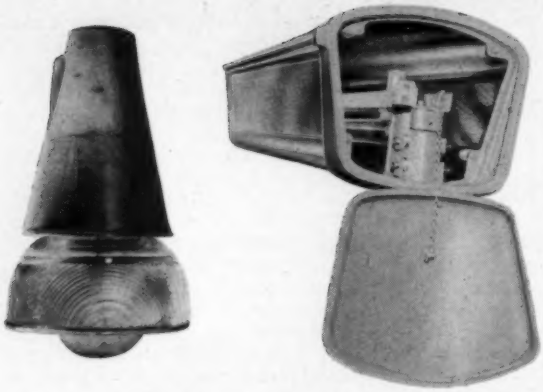
*Horstmann "Type Y" Mark II time switch*



*"Ware" Mark III lantern (Engineering & Lighting Equipment Co., Ltd.)*



*G.E.C. lantern for two, three or four 5ft 80 W fluorescent tubes*



*Left: Revo lantern for top or side mounting. Right: Access to the A.E.I. "Amberline" lantern designed for the new 200 W sodium lamp is through the main casting*

in cross-section and is available in heights from 30 to 60ft in 5ft increments. It can be supplied with a round, rectangular or octagonal platform, and an access ladder is available with or without safety loops. The "Tripole" is available in heights ranging from 20ft to 40ft in 5ft increments for mounting up to six floodlights and a ladder is incorporated in the structure. The company also manufactures a standard high-level tower available for heights between 40 and 150ft.

The stand of Victor Products (Wallsend), Ltd., was entirely devoted to a new miniature fluorescent lighting fitting suitable for one or two 12in, 8 W tubes. Electrical isolation is possible as soon as the cover is opened and when it is closed it is held by a spring clip so that the captive-key-operated fastening screw can be tightened at leisure. The fitting is sold complete with tube.

No fewer than twenty-two types from their range of synchronous time switches, including solar dial models for street lighting control and other applications, were shown by Sangamo Weston, Ltd. Other models included switches for use with multiple-lamp lanterns as well as spring reserve models. The latter are synchronously controlled when the current is on and have a reserve of at least 18 hours in the event of interruption of supply. Examples of a.c. watthour meters included single-phase and two- and three-element polyphase patterns, and there was also a representative selection from the range of the company's measuring instruments covering all requirements from laboratory standards to miniature panel instruments and other switchboard and panel models.

A demonstration of speed-timed vehicle extensions of the minimum green period formed a feature of the stand of the Automatic Telephone & Electric Co., Ltd. At signalled junctions served by the type 54 controller, which has been developed to the specification of the Ministry of Transport, the duration of the minimum green period is automatically related to the number of vehicles waiting for the green. Vehicles that operate the detector after the commencement of the green extend its duration to the extent necessary to ensure safe clearance of the junction. The duration of each vehicle extension is automatically related to the value of the unexpired minimum green, the speed of the vehicle and the distance the vehicle has to travel. Vehicle extensions are non-additive and an extension for a fast vehicle may be absorbed in an extension for a slow vehicle that operated the detector just prior to the fast vehicle. Also exhibited was the type 52 controller, a simple two-phase unit to provide safe periods of right-of-way for pedestrians.

Philips Electrical, Ltd., gave prominence to their range of high-wattage integral-jacket sodium lamps. A large photographic display showed the recent 280 W sodium lamp installation along the A8 highway, linking Glasgow and Edinburgh, at Baillieston—the first installation of its kind in the world. The 280 W lamp comprises two independent 140 W sodium lamps mounted end to end. No special control gear is necessary as each discharge tube operates on conventional ballasts which permit independent operation for half-night burning. In the Baillieston installation the "Eleco Golden Ray 280" lantern is used. There was also an illustration of the 700 W mercury fluorescent lamp installation at St. George Square, Glasgow. The 250 W and 400 W mercury discharge lamps with the quartz tube technique shown experimentally last year and now available to public lighting authorities, were again exhibited, and there was a display of the complete range of Philips lightweight, small dimensional polyester control gear for sodium and mercury lamps. Other Philips items on show included sealed beam, pressed glass lamps and fittings which have many interior and exterior applications; the fluorescent inspection handlamp; a display of circular fluorescent fittings; and a floodlight for the 1,000 W, MB/U lamp.

A number of illuminated display panels, showing a variety of time switches for street lighting, formed an interesting feature of the Venner stand. The range included synchronous motor driven units (with or without spring reserve) and electrically-wound clocks with spring reserve. Also included were single-, double-, or triple-pole types for controlling loads from 5 to 50 A. Two types of box, one plastic, the other die-cast, have been introduced for the large-dial 20 A synchronous solar dial time switch type MSQP and also a clear plastic dial and switchgear cover for positions where space is restricted and a totally enclosed case is not required.

The display of electrical time switches shown by the Horstmann Gear Co., Ltd., included the latest "K" Mark II and "Y" Mark II units. The former is a synchronous motor driven switch suitable for use on 200/250 V, 50 c/s time-controlled frequency, but units for most other voltages and frequencies can be supplied to order. Hand-set or solar compensating dials can be provided. The "Y" Mark II switch is electrically wound and incorporates a 12-hour spring reserve. It can be easily fitted into the base of a modern lamp column where space is usually limited and, as the unit can be plugged in, the switch and clock movement may be removed without disturbing the wiring in any way.

An interesting new switch, the type "Q" Mark III, is a small model arranged to control two circuits so that full lighting, which is switched on at dusk, may be reduced to half lighting at or about midnight and finally switched

*Above: Siemens "Coventry Osprey" lantern for 3ft linear sodium lamps*

*Right: Victor Products miniature fluorescent fitting for 12in 8 W tubes*

off at dawn. The capacity at 250 V is 10 A a.c. per circuit and either synchronous motor driven or electrically wound movements can be supplied. Among the other switches on view was the heavy duty type "EH" which is suitable for the control of circuits up to and including 50 A a.c. or 25 A d.c. at 250 V. A selection of weatherproof and moulded boxes was also shown and the Horstmann flasher unit for the control of beacon lights at pedestrian crossings.

Six new street lighting lanterns were shown for the first time by the General Electric Co., Ltd. The first is a cut-off distribution type using an "Osram" 250 or 400 MA/V lamp and designed for higher mounting heights and greater spacings than are normally adopted in cut-off lighting installations. A decorative post-top lantern for side-road lighting uses two vertical "Perspex" refractors to control the light from two vertically-mounted 40 W fluorescent tubes. Of two other side-road lanterns, one is designed to use 3ft 30 W tubes operated horizontally, while the other incorporates a single 60 W sodium lamp.

The fifth new lantern is designed for two, three or four "Osram" 5ft 80 W tubes. To achieve high resistance to atmospheric corrosion the main body of the lantern is made of aluminium extrusions and castings, the optical system of "Perspex," and the fittings of stainless steel. Finally, there was a demonstration of a prototype lantern unit to accommodate an experimental 3ft 200 W high power "Osram" sodium lamp with an initial efficiency of about 100 lumens per watt. A feature of the display of "Osram" lamps and tubes for public lighting was a new 400 W mercury fluorescent lamp with internal reflector and good colour-rendering properties which is to be marketed on 1st November.

During the conference the G.E.C. demonstrated on three public buildings in Aberdeen a new system of dramatic illumination called "Anilume." This brings a new versatility into this realm of lighting by the use of remote radio control to effect changes in colour, sequence and direction. The technique is aimed to overcome the criticism that the "spectator appeal" of floodlit buildings is short-lived after the first switching on.

The display of tubular steel street lighting columns by Stewarts & Lloyds, Ltd., in the outdoor exhibition included twelve designs suitable for use on either Group A or Group B roads. The columns were fitted with pendant, side-entry and fluorescent lanterns by the manufacturers for the period of the conference. The indoor display included photographs of lighting installations, models, and some detailed samples of lighting column construction.

Stanton Ironworks Co., Ltd., displayed ten pre-stressed spun concrete lighting columns all of which have been approved by the Council of Industrial Design. As a result of the interest shown in the No. 10 column a new column (No. 11) has been designed for intermediate mountings and this was shown for the first time. Photographs of lighting column installations, scale models and sections were shown on the company's stand. Metal Developments, Ltd., showed examples of their "Lucerna" and "Sheerline" aluminium alloy street lighting columns.

The wide range of capacitors for street lighting purposes shown on the stand of A. H. Hunt (Capacitors), Ltd., included the type L 89/5 standard oil-filled capacitors for discharge lighting applications in all climatic conditions and the type L 89/4 "Therminol" capacitors which are recommended for indoor and temperate conditions, where their smaller dimensions are advantageous. Both types are housed in non-rusting containers with welded lids, and have integral fixing brackets with earthing terminal. Also shown were "Therminol" type 89/1 capacitors for fluorescent lighting and a range of smaller units for bulk power factor improvement.

*G.E.C. cold cathode fluorescent lanterns are mounted on columns to light the square where Union Street, Aberdeen, widens out to Castle Street*

Optical systems that fulfil the most exacting conditions of light distribution were evident in the Holophane display. For Group A lighting the oval bowl refractor (22/4257D) can be used with 250-400 W fluorescent mercury discharge lamps or MA/U lamps of similar rating. To provide a non-axial asymmetric distribution the refractor is tilted at 15° and in the more usual horizontal position it gives a wide asymmetric distribution. The lantern body is die-cast in silicon aluminium alloy. Also in the Holophane Group A display were the 400 W "Acorn" mercury lantern (type MBF/U), which combines good colour rendering and appearance with a highly efficient light distribution, and the "Cylindrical Sodium" lantern (type 50/H).

Group B lighting was catered for in a wide range of dome and bowl refractors providing alternative light distribution characteristics for narrow roads (type B) and broad roads (type B2). These are of single-piece design suitable for g.l.s. and mercury discharge and fluorescent lamps. In addition, there were "Lumifractor" almost all-glass lanterns for secondary roads, and the "Muralux" side-of-house weatherproof lantern for efficient and economical two-way non-axial distribution for lighting narrow streets where columns are not practicable.

The stand of Permanoid, Ltd., recorded the past and present development work of the company in the field of plastic cables and insulating sleevings, particularly at high operating temperatures. Among the cables for street lighting applications were p.v.c. cables with steel armouring wires, which couple excellent electrical characteristics with high mechanical strength, resistance to corrosion and reduced weight and dimensions. The "Gulf" type cables satisfy normal I.E.E. current ratings at ambient temperatures up to 65°C and can be used in an ambient temperature range of +75°C to −20°C. The deformation under test has been reduced from the B.S. requirement of 35 per cent at 70°C to 6 per cent at 100°C.

The Engineering & Lighting Equipment Co., Ltd., showed a comprehensive range of their "Eleco" street lighting lanterns for both Group A and Group B applications. Of particular interest was the "Golden Ray 280"

which has been specially designed to take the 280 W Philips integral jacket sodium lamp. The lantern has a die-cast aluminium top casting and bowl ring and one-piece "Perspex" bowl with sealed-on machined and polished refractor panels. It can also be used with two 140 separate jacket sodium lamps or with the A.E.I. 200 W lamp.

Among the exhibits of mobile erection equipment was the two ton "HIAB" hydraulic lorry loader demonstrated by George Cohen, Sons & Co., Ltd. This is designed as a single unit and can be fitted to virtually any vehicle—including articulated types—with a pay-load of five tons or more. The standard model is capable of slewing through 180° but it can also be supplied for slewing through 359°. The telescopic boom extension has a maximum out-reach of 13ft and a lift height of 20ft.

Additions to their range of Group B street lighting lanterns and an aluminium column designed with a suitable bracket or spigot fixing to match these lanterns were a feature of the stand of Atlas Lighting, Ltd. The new "Beta Four" lantern, which will be available for general sale next year, is a totally enclosed lantern for Group B roads using tungsten or mercury lamps. An alternative lantern for such light sources is the company's new "Gamma Five" lantern for post-top mounting. An example of the development of high-level lanterns with outputs up to 20,000 lumens was the "Gamma Four" post-top mounting lantern for two 250 W or 400 W colour-corrected mercury fluorescent lamps. The "Alpha Three" lantern, which was specifically designed for use with the same types of lamp, is now available with an aero-screen. The contour of the super-purity aluminium canopy-reflector ensures medium-angle beam distribution with semi-cut-off characteristics.

# PROGRESS IN STANDARDISATION

THE growing demand of industry for new standard specifications on which to base production and purchasing requirements is emphasised in the annual report of the British Standards Institution for the year ended 31st March last. The report points out that, although the number of standards published dropped slightly during the year under review, it is significant that there has been a sharp increase in new projects to be undertaken in the technical divisions: in the engineering division 144 as compared with 92 last year; in the building division 34 compared with 17; in the chemical division 48 compared with 16.

The growing support given by trade and industry to the work of the British Standards Institution is apparent from a further big rise in the number of new subscribing members. The total number of members now in the B.S.I. is 10,605 compared with 9,964 at the end of the previous year. This year has seen the start of a new phase of the Institution's activities, with the decision to undertake testing on a limited scale in new premises at Hemel Hempstead. Hitherto, the B.S.I. has relied for virtually all testing facilities on outside agencies and the new facilities will cater for some of the testing required under certification mark schemes and for certain electrical testing in connection with the work of the B.S.I./Canadian Standards Association Agency, whose staff will operate from the Hemel Hempstead centre. The building has been constructed on the modular principle and forms part of the experimental building programme being carried out in connection with the European Productivity Agency's project on modular co-ordination. This new centre and a new sales office in Bristol are this year's additions to the B.S.I.'s premises outside London.

In London itself, to meet the growing demands of the work for the ordinary consumer, stimulated by the activities of the Consumer Advisory Council and Women's Advisory Committee, new premises at Orchard House, Oxford Street, have been opened. This enables the consumer section to work as a self-contained unit.

The report refers to an increasing awareness of the need to use standards effectively in production. Efforts are continuing to ensure as close contact as possible between the Institution and those who use standards, and to promote education in standards through conferences and discussion groups at various levels in industry, as well as amongst students. Special efforts are being made to see that technical colleges place emphasis in their courses on standards techniques.

During the year there was a further increase in the number of standards under which certification schemes operated; the total stood at 145 on 31st March. In the electrical field p.v.c. and polythene insulated cables and fluorescent lamps were among the products for which certification schemes were being considered. The report illustrates the rapidly increasing impact of standards on all aspects of export business. The growth of international standards work, the sharp rise in demand for overseas standards by British exporters, the increasing activities of the B.S.I./C.S.A. Agency for approval of electrical equipment exported to Canada, the attention being given to publicity for British Standards overseas, all illustrate the way things are going.

More attention is being given to the translation of British Standards, or summaries of them, into foreign languages. The report contains details of developments during the year in the activities of the International Organisation for Standards (I.S.O.) and the International Electrotechnical Commission (I.E.C.). Reference is also made to the proposed integration of standards among the countries of the European Common Market.

Copies of this 272-page publication are available from the B.S.I. at 2, Park Street, London, W.1, price 7s 6d.

## Australian News

THE Australian Atomic Energy Commission expects to begin building its first nuclear power station in five or six years' time. The Minister for National Development, Senator Spooner, in announcing this, said that by 1980 the capacity of nuclear stations might be 1,000 MW. The first nuclear stations were likely to be small and would be situated where they could be more economical than conventional power stations.

The State Electricity Commission of Victoria is to carry out a regular monthly patrol of 700 miles of its transmission system by helicopter. As much of the territory to be covered is rugged mountain country, not only will there be a saving in time and cost, but a more thorough inspection will be possible than from ground patrolling.

Costs of manufacturing, distributing and retailing, already high in Australia, will be increased if the latest Australian Council of Trade Unions demand is met. This is for a 35-hour working week with three weeks' paid holidays a year. One union, indeed, is seeking a 30-hour week.

# LAMP SALES PROMOTION

WITH the approach of the lighting season, lamp manufacturers have again prepared a wide and attractive variety of material for publicising their lamps.

Crompton Parkinson, Ltd., are launching this month a nation-wide publicity campaign for their "Life-Light" lamps, which will have as its main platform the "point of sale." Much of the material produced is particularly suitable for window displays, and includes a new panoramic centrepiece which is adaptable to either small or large window spaces and to awkwardly shaped windows. Two other display items for windows are a suspension type "mobile" and a cut-out showcard, both items in colour and of a three-dimensional form. These, with the centrepiece, literature, lamps and samples of the new fold-in type lamp securing packs, can be used to form a collective display, and the company is offering to dress windows free of charge.

For use inside premises, there is a floor-standing lamp dispenser. This has been designed to facilitate "self-service" and whilst having a capacity for up to seventy-five lamps, only a little over 1 sq ft of floor space is required. A rubber cash mat with a two-colour design is also being offered and, again, there will be a variety of sales literature available, including catalogues, price cards and price lists, for both sales assistants and consumers. Stockists can obtain all the material mentioned from their nearest Crompton Parkinson branch or depot.

Car bulbs and lamps with industrial applications are to be publicised separately, and for these literature and a wall chart are available. Advertisements will appear in the motoring trade and industrial Press.

## "Osram" Publicity

The theme of the lamp publicity campaign of the General Electric Co., Ltd., is "Osram Adds Life to Your Lighting," while the familiar phrase, "the Wonderful Lamp," will be used to supplement the new slogan. The new poster has the new phrase printed in red, white, blue and yellow lettering on a black background, and the slogan "the Wonderful Lamp" appears inside the outline of the lamp at the foot of the poster.

This year an extra 500 poster sites will bring the total to 5,000. Other outdoor advertising will appear on 162 special signs and bulletin boards and on 100 Midland Red buses. A neon sign, based on the new poster, will be installed in Piccadilly Circus to replace the existing "drummer boy" design. Full-colour advertisements will appear in women's magazines and the advertisements of fluorescent tubes in provincial daily and weekly papers and in periodicals will continue from October to December. The main emphasis will be on the advantages of the "universal start guaranteed tube." Separate advertising will be run for photographic and street-lighting lamps and for vehicle bulbs. The last will tie in with the "Be a Better Driver" campaign.

The new "Osram" slogan is the theme of the window dressing service. It appears on the centrepiece of two new window display units and the word "Life" is illuminated on one of them by a flashing device; this unit also has a platform for displaying lamp cartons. New display material includes a 14½in by 9½in reproduction of the poster in full colour and a similar article with "horizontal" layout for clipping to the top or bottom of the "Perspex" sign introduced last year. This indoor illuminated sign will again be available to retailers. Added to the existing "Trapinex" paint transfers for doors and windows will be a similar transfer for fluorescent tubes. "Osram" lamps and decoration sets will be shown in the autumn edition of the G.E.C. booklet, "Living Electrically." Separate price booklets for lamps and tubes, and vehicle bulbs, and a full catalogue of photographic bulbs and equipment will also be available.

## "Deeper Siemanship"

The autumn lamp sales campaign launched by Siemens Edison Swan, Ltd., centres around the spectacular "built-in" lighting system of some deep-sea fish. The theme of the series suggests that although nature has equipped these submarine creatures with the most efficient means of lighting known to man, Siemens Edison Swan have themselves been in the same business for some years now, and they can offer a comparable lighting service which is both inexpensive and long-lasting.

Full-page advertisements, including some in full colour, have been planned in a wide range of technical and trade publications. This drive is supported by full colour double crown window display showcards and posters which can be linked in sets of five, or shown as individual pieces. Smaller showcards (15in by 12in) for window or counter display, and other cards dealing with specific lamps, are also available.

*Left: "Osram" display unit which includes a flashing device. Centre: Crompton lamp dispenser with a capacity for seventy-five lamps. Right: The "Hatchet fish," which provides its own illumination, is one of three "fish" illustrations for publicising Siemens Edison Swan lamps*

# SHOP LIGHTING

## INSTALLATIONS IN MODERN STORES

*Right: Scala Market, Wolverhampton, lighted by Philips lamps. Below: G.E.C. "Oxford" lighting fittings at Edwin Jones, Ltd., Southampton. Bottom: Lighting by Harris & Sheldon (Electrical), Ltd., at the Kendal Milne store, Deansgate, Manchester*

A SYSTEM of high brightness pattern lighting has been installed at the new department store of Edwin Jones, Ltd., a subsidiary of Debenhams, at Queen's Building, Queen's Way, Southampton. The system consists of 400 G.E.C. "Oxford" lighting fittings of three types: one to light main areas, one for stairways and another for perimeters. Lighting in the hairdressing salon, restaurant and café is mainly by small decorative fittings designed to merge with the décor. There are 4,389 lighting points with "Osram" tungsten lamps and mercury vapour lamps, and 3,083 fluorescent tubes.

The fittings for lighting the main areas are each designed as a hollow square. They house 5ft 80 W fluorescent tubes and give an average illumination of 60 lm/sq ft. To reduce the weight suspended from the ceiling, the control gear is mounted remotely above a false ceiling. Additional lighting is provided by fluorescent tubes in showcases and by fittings arranged to light special displays.

Display windows are lighted by 150 W tungsten lamps and 125 W mercury lamps in mirrored glass reflectors, mounted alternately and spaced at 2ft centres along the front of each window. Background lighting is provided by continuous rows of 8ft 124 W warm white tubes screened in ceiling recesses. The two main corners of the building are floodlit.

In addition to the lighting system the General Electric Co., Ltd., has supplied a main control panel, while the 150-line automatic telephone switchboard has been supplied by the Reliance Telephone Co., Ltd. The main electrical contractors were D. Alldridge & Co., Ltd., Southampton, the electrical consultant was Mr. A. W. Jervis, of Debenhams, Ltd., and the architects for the building were Healing & Overbury, Cheltenham.

The importance of high standards of lighting in the self-service field is emphasised by the installation at the Scala Market, Wolverhampton, where an illumination level of 50 lm/sq ft has been achieved by the use of double-coated colour 32 fluorescent lamps supplied by Philips Electrical, Ltd. These are mounted in semi-continuous Philips TB.17 fittings of the bi-pin type. The installation was carried out by Hill & Priest, of Stourbridge.

The fourth floor of Kendal Milne, Deansgate, Manchester, has recently been relighted by Harris & Sheldon (Electrical), Ltd., under the direction of Mr. W. Goulden, the store engineer. General lighting is from "Kestrel" fluorescent fittings, supplemented by special "cornice light" fittings mounted under the ventilating ducts. The "Kendal," an eyeball spotlight specially designed to allow a beam up to 30° below the horizontal, is used for display lighting at the corner of each duct. In addition, a large number of "Ironic" glass pendants are used round the periphery of the room, and showcase and counter lighting is provided.

# *Electrical Review* DATA SHEET FOR THE LIGHTING ENGINEER

We believe that the provision of this information, in a compact form, will be of assistance in the planning of lighting installations to ensure adequacy and suitability

## ILLUMINATION DEFINITIONS AND FORMULAE

### DEFINITIONS

### *(1) General*

(*a*) Solid Angles, $\omega$. $\omega = \dfrac{\text{Area of Spherical Surface}}{(\text{Radius})^2}$ Steradians (undimensional)

In a sphere of radius r, total solid angle $= \dfrac{4\pi r^2}{r^2} = 4\pi$ Steradians.

### *(2) Dependent on Source*

(*a*) Luminous Flux, F. Rate of light energy radiation. $F = I\,d\omega$ Lumens (lm)
1 Lumen = Flux in unit solid angle with point source of 1 candela
Total spherical luminous flux from a central point source of I candela $= 4\pi I$ lm

(*b*) Luminous Intensity, I. Intensity of light in a particular direction. $I = \dfrac{dF}{d\omega}$ candela (cd)

1 Candela (or Candle Power) = Intensity of a source which has a flux of 1 lumen/steradian

If F is the total luminous flux from a point source, $I = \dfrac{F}{4\pi}$ cd

(*c*) Luminance or Brightness, S. Luminous intensity per unit projected area.

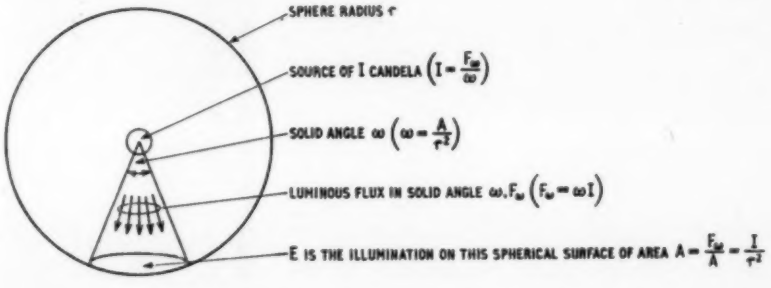
$$S = \frac{I}{\text{Projected Area}} \text{ cd/ft}^2$$

### *(3) Independent of Source*

Illumination, E. Density of luminous flux (F) on a surface. $E = \dfrac{dF}{dA}$ lumens/sq ft (lm/ft$^2$)

1 Lumen/sq ft = Illumination on a surface of 1 sq ft normal to the direction of a flux of 1 lumen

Illumination on a spherical surface distance r from a point source $= \dfrac{dF}{d\omega(r^2)} = \dfrac{I}{r^2}$ lm/ft$^2$


SPHERE RADIUS r
SOURCE OF I CANDELA $\left(I = \frac{F_\omega}{\omega}\right)$
SOLID ANGLE $\omega$ $\left(\omega = \frac{A}{r^2}\right)$
LUMINOUS FLUX IN SOLID ANGLE $\omega$, $F_\omega$ $\left(F_\omega = \omega I\right)$
E IS THE ILLUMINATION ON THIS SPHERICAL SURFACE OF AREA $A = \frac{F_\omega}{E} = \frac{I}{r^2}$

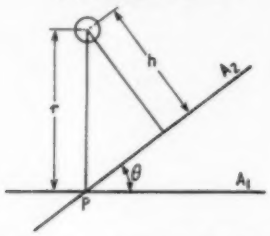
## ILLUMINATION FORMULAE

### *(1) Inverse Square Law*

The illumination of a surface is inversely proportional to the square of the distance from the source. This follows from definition (3):—$E = \frac{I}{r^2}$

### *(2) Cosine Laws*

(*a*) Inclined Plane



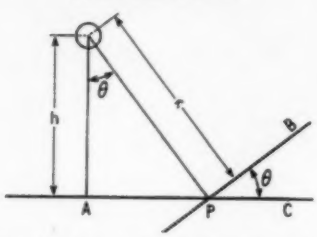

Illumination on plane $A_1$ (at P) $= E_1$

$$E_1 = \frac{dF}{A_1} = \frac{I}{r^2}$$

Illumination on plane $A_2$ (at P) $= E_2$

$$E_2 = \frac{dF}{A_2} = \frac{dF}{A_1} \text{ Cos } \theta = E_1 \text{ Cos } \theta$$

(*b*) Inclined Beam




Illumination at P on plane B $= E_B$

Illumination at P on plane C $= E_C$

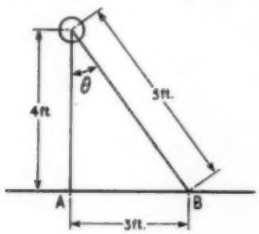
$$E_C = E_B \text{ Cos } \theta = \frac{I}{r^2} \text{ Cos } \theta$$

$$= \frac{I}{h^2} \text{ Cos}^3\theta = E_A \text{ Cos}^3\theta$$

To apply these formulae, the luminous intensity of the lamp along the normal to the point on the plane at which it is desired to calculate the illumination must be known. This can be obtained from the polar curve of the luminous intensity for the lamp in its fitting. Thus, some of the factors in the practical method shown (i.e. type of fitting and source) have already been included in this method but other factors, e.g. room dimensions, reflection, etc., are not considered.

### EXAMPLE

If the luminous intensity of a point source in all directions below the horizontal is 500 candelas, find the illumination at A and B.




$$E_A = \frac{500}{4^2} = 31{\cdot}2 \text{ lumens/sq ft}$$

$$E_B = E_A \text{ Cos}^3\theta = 31{\cdot}2 \left(\frac{4}{5}\right)^3 = 16 \text{ lumens/ sq ft}$$

# SIMPLIFIED PRACTICAL INTERIOR LIGHTING DESIGN

The art of illumination design lies in determining the relationship between the light output from the source and the light received on the working plane. For example, if the average illumination on a working plane with an area of 2 sq ft is to be 30 lumens/sq ft and if all the light output of the source in all directions reaches the plane alone and without any losses, then the required illumination could be obtained by a 5 watt tungsten lamp, having an output of 12 lumens/watt (see table below). This of course never applies in practice.

The relationship between the light output and the light received depends on a number of factors, which are tabulated in lighting handbooks.*

### *Factors*

M Maintenance, to allow for dust and age. Usually 0·8.

D Depreciation $= \frac{1}{M}$

A Absorption, to allow for polluted atmosphere between lamp and surface (not usually applicable).

R Reflection. This factor is included in U.

U Utilisation. Depends on fitting, room dimensions, reflection, etc.
This factor is tabulated in lighting handbooks.

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* Such as:—" Interior Lighting Design," British Lighting Council. 1958. Price 5s.

## *Form of Calculation*

(1) Decide the illumination required on the working plane.
Recommended values for most applications, 15–25 lumens/sq ft
(Factories Act requires minimum of 6 lumens/sq ft on a horizontal plane 3 ft high).

(2) Decide the type of source and fitting

| Type | Lumens/watt | Life Hours |
|---|---|---|
| Tungsten | 11–15 | 1,000 |
| Hot cathode | 40–60 | 5,000 |
| Cold cathode | 30–50 | 10,000 |

*Economics*

If the lighting is required for only a few hours every evening (say 400 hours per annum maximum) use g.l.s. lamps. If the lighting is used during daytime (above say 400 hours per annum) use hot cathode fluorescent tubes.

(3) Determine the mounting height and the height of the working plane.

(4) Determine the spacing and the number of fittings required.
For indirect and semi-indirect fittings:—
maximum spacing = 1½ (height of *ceiling* above working plane)
For direct, semi-direct and diffusion fittings:—
maximum spacing = 1½ (height of *fitting* above working plane)
Spacings between end fitting and walls should be a maximum of half the above figures.

(5) Determine the " Room Index," which depends on room dimensions and mounting height, from tables in lighting handbooks.

(6) Determine the reflection factors of the room fabric.
Usual values are:—White ceilings—70 per cent.
Medium walls—30 per cent.

(7) Determine " Utilisation Factor," which depends on Room Index, Reflection Factors and type of fitting. " U " must also be obtained from tables in lighting handbooks.

(8) Decide maintenance factor. A factor of 0·8 is usually adequate.

(9) Calculate average lumens required per lamp from:—

$$\text{Average Lumens/lamp} = \frac{(\text{Average illumination required}) \times (\text{Area per fitting})}{(\text{Number of lamps per fitting}) \times (U) \times (M)}$$

(10) Decide lamp wattage required.

## EXAMPLE

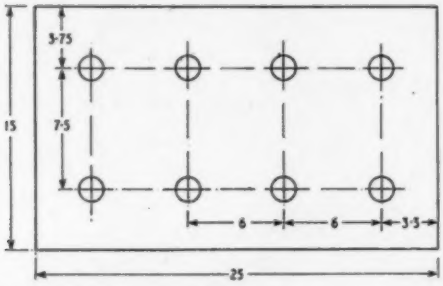
A room measures 25 ft by 15 ft by 10 ft high and has a white ceiling with light blue walls having a reflection factor of about 40 per cent. Dark curtains and windows are assumed to reduce this factor to 30 per cent. Lighting will be required only during the evening.

(1) Base the design on 20 lumens/sq ft. This will be adequate for reading fine print, sewing and general offices.

(2) A semi-direct fitting, which gives 55 per cent light downwards and 15 per cent upwards, will be chosen. As the lighting will be required only at night, it will be more economical to use g.l.s. lamps.

(3) Working plane—3 ft above floor. Fitting mounted—2 ft below ceiling.

(4) Maximum spacing = 1½ (10–3–2) = 7·5 ft.




$$\text{End spacing} = \frac{7{\cdot}5}{2} = 3{\cdot}75 \text{ ft.}$$

These spacings can be obtained with the layout shown, giving a total of 8 fittings. In this instance, with a high lighting level of 20 lm/ft², and a rather high working plane, it would probably be permissible to increase the longitudinal spacing to 8 ft 4 in. This would require only 6 fittings.

(5) From tables, " Room Index " = E

(6) Reflection factors:—Ceilings 70 per cent, walls 30 per cent.

(7) From tables, " U " = 0·42

(8) Maintenance factor = 0·8

(9) $\text{Average Lumens/lamp} = \dfrac{20 \times 25 \times 15}{8 \times 0{\cdot}42 \times 0{\cdot}8} = 2{,}700$ lumens.

(10) Tables show that the lumen output of a 200 W g.l.s. lamp is 2,720 lumens

(or very roughly from table under item (2) above:— $\dfrac{2{,}700}{13} \simeq 200$ W)

This may seem a large output for lighting a small room but this design would preclude the large shadow areas usually associated with domestic lighting. In many cases, domestic illumination is often as low as 3 lumens/sq ft.

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# British Association

## FURTHER PROCEEDINGS AT YORK

A NUMBER of papers of electrical engineering interest were given during the latter part of the annual meeting of the British Association for the Advancement of Science at York. A brief historical survey of man's ideas on the structure of matter was given on the Monday morning in a lecture to the Mathematics Section by Dr. P. T. Matthews. The idea that if matter is analysed in sufficient detail basic elements so simple that further analysis is impossible would be discovered was a logical consequence of the approach introduced by the Greeks. The first major step in this direction was the discovery during the 19th century of the 92 elements, each having a structure of electrons circling a relatively massive nucleus. The nucleus of hydrogen was a proton, and for a brief period in about 1930 it seemed possible that all matter, including the atomic nucleus, comprised protons and electrons.

Further research into the structure of the nucleus with high energy particle accelerators had, however, presented an increasingly complex picture. Neutrons and mesons were added to the list of elementary particles, the former to give the nuclei their observed mass and the latter being a form of "adhesive," and there were now some 30 elementary particles — including anti-particles — which had themselves been shown to have an observable structure. The reasons for the existence of so many particles and their purpose were not yet fully known, and it was in this field that some new contribution must be made.

### Computers and Transport

The principal characteristics of automatic computers were outlined in a paper presented to the Engineering Section by Brigadier G. F. Hinds with some examples of their use by the British Transport Commission and proposals for their further exploitation. The use of a computer for seat reservations was proposed by Babbage in 1823 but, although technically elegant, it was rejected for economic reasons. The first task completed was the calculation of the shortest distances between 4,000 local groups of railway freight terminals, effecting a saving of some 200 man-years.

Eight computers were now owned by British Railways, being employed on pay calculations and stores accounting. If ticket issuing machines recorded information in a form suitable for direct use in computers, auditing and obtaining traffic information would be greatly simplified, and proposed methods using punched tape or an electronic character reader were being examined. A device signalling the identity of a passing bus by a series of fixed points in a manner suitable for direct computer use was employed by London Transport and a similar machine was being developed for use with freight wagons. The greatest benefits from computers were expected in operational research; already the distribution of locomotive coal had been optimised, while the research department used a computer for trials analysis and many engineering problems. The composition of timetables and design of interlock diagrams in signal boxes were being investigated.

### Crystal Physics

Two papers were presented to the Mathematics and Physics Section on crystal physics. Electrons in crystals were discussed by Professor G. F. J. Garlick, who said that the fundamental interest of physicists was to explain the external forms and physical properties of solid matter in terms of its atomic constitution. Most solids had a crystalline nature, their atoms forming three-dimensional arrays. The optical and electronic properties of crystalline solids depended on the behaviour of electrons inside the crystals. The electron could no longer be regarded as a tiny particle with a negative electric charge, but its wave-like properties, first revealed in electron diffraction by crystals in 1927 by Davisson and Germer, had to be considered. The faster an electron moved, the shorter was its wavelength. In free space, the wave nature of an electron permitted normal behaviour as a charged particle, but in the regularly repeating lattice of a crystal abnormalities occurred. Electrons belonged to the whole crystal and could not be found at localised places unless the crystal was imperfect or impure, and when electrons left given energy states the spaces remaining could move as positively charged electrons or positive holes.

The use of coloured crystals as model solids was discussed by Mr. R. V. Hesketh and Dr. E. E. Schneider. Alkali halide crystals, of which common salt was a typical example, were very simple solids and in their pure form were perfect insulators. They had a simple structure, were held together by only one type of binding force and, being transparent to a wide radiation band, formed an ideal background for studying the role of imperfections in the behaviour of solids. The simplest imperfections were vacant lattice sites, which on irradiation became occupied by electrons or holes and gave the crystal a characteristic colour. This colour allowed direct experimental demonstrations of electronic conduction phenomena, the mechanisation of radiation damage, plastic deformation and dislocation lines and networks.

### Radiation Damage

Economic electricity production is now a predominant feature in reactor design, implying a need for long-life fuel elements to allow maximum burn-up before expensive reprocessing, the avoidance of structural elements which absorb neutrons wastefully, and steady operation on maximum load. These factors raise problems involving the effects of radiation on materials—the distortion of uranium in fuel, weakening and embrittlement of structural metals, and energy storage in the graphite moderator (since annealing away Wigner energy in the latter costs running time and possibly extra capital)—and in a paper read to the Physics and Engineering Sections Dr. W. M. Lomer discussed radiation damage and atomic displacements in crystals.

In dealing with some of the long-term work carried out at Harwell, Dr. Lomer said that it had been known for many years that after long irradiation graphite contained much stored energy, some 80 cal/gm of which, enough to raise its temperature from 100 to 400°C, could be released relatively easily. The original method of control by annealing was under review at the time of the Windscale accident in 1957. Detailed analysis then showed that the energy release could be represented as a complicated temperature activated process, and at the Geneva Conference methods for accurately predicting the properties of a whole reactor from measurements of graphite samples were published. Subsequent work

showed that the methods used then could not be extended to the prediction of the slow accumulation of damage or to laboratory experiments. A more complex model must be developed to assist in interpreting the results of experiments on damage build-up rate, and permit the use of the results of isolated high dose rate experiments in the design of long-life reactors. An examination of the possible explanations for the way in which bubbles of gaseous fission products made uranium metal swell under neutron flux had established that the initiation of the growth was the difficult stage and was sensitive to the perfection of the uranium crystal, and that the early stages of growth occurred because of atomic diffusion. Electron microscope work on thin foils should elucidate the relation between dislocations and bubbles.

## Tennessee Valley Development

In a paper given to the Geography Section, Professor W. B. Fisher discussed the past 25 years of the Tennessee Valley project, which began in 1933 to improve living standards in a poor and declining region of the United States and provide Federal relief work during economic depression. River control to reduce flooding and soil erosion, the development of river navigation, and provision of cheap electricity were the bases of the plan. Results included power at about half the price of that in the rest of America, with some 95 per cent of the farms supplied, compared with 3 per cent when the project started, while considerable industrialisation had taken place, largely since 1948. The starting of two atomic research plants at Oak Ridge had created an urgent and unsatisfied demand for more electrical power—the two plants requiring more than half of that generated by T.V.A. Practically all water resources were now being used for generation, and some 70 per cent of the generating capacity included coal burning plant, the Authority being the largest single customer for coal in the United States.

The urgent need for expansion of thermal power plant had led to considerable political discussion. Relief and public works were acceptable, but for an official Federal project to become one of the largest electrical corporations in the country and compete with private enterprise was not. In two years authorisation to expand the steam generating plant had been refused in Washington five times, until authority was somewhat surprisingly given last month. Planning and regulation and the large-scale transformation of the geographical environment by scientific methods were increasingly essential for the world in general to provide for growing populations. The Tennessee Valley project had lessons of general import for many other parts of the world.

## Novel Techniques

Three short papers dealing with novel techniques were read to the Physics Section on the following morning. The transfer of material in high-current arc discharges was considered by Mr. L. King, who discussed the jets observed in the high-current arc on the basis of a theory of dissociation and ionisation, and showed how the jets accounted for the material transported in the welding arc. Slides and film produced by the Electrical Research Association illustrated jet formation at various currents, and by using high-speed photography the effects of correct and incorrect welding current were illustrated. The strong jets produced by excessive current removed the weld metal, while with too little current metal droplets from the welding rod merely fell under gravity and solidified on the metal to be welded.

In his paper, Dr. N. W. Robinson said that the range of ultra-high vacuum was taken to be pressures below $10^{-8}$ mm Hg, while the lowest pressure reported to have been attained in the laboratory was $10^{-14}$ mm Hg. Pressures of $10^{-10}$ mm Hg were readily obtained under production conditions in some microwave thermionic tubes. Diffusion pumps were employed to evacuate vessels to pressures of $10^{-7}$ mm Hg and below that ion pumps or getter ion pumps were used. Getter ion pumps operated by adsorbing gas molecules on freshly-formed titanium or zirconium surfaces. The presence of an ionising electron stream increased the pumping speed. The lowest pressures had been attained by using ion pumping and liquid helium traps. Under ultra-high vacuum conditions gas-solid interface phenomena could be studied with the minimum contamination by unwanted molecules. At pressures of $10^{-6}$ mm Hg a surface became covered by a monolayer of residual gas in 2·6 sec, but three days were required at $10^{-11}$ mm Hg, giving time for experiments to be carried out on clean surfaces.

Cryotrons and other superconducting computer devices were discussed by Dr. J. M. Lock. Although superconductivity meant the complete absence of electrical resistance in a metal, it was possible to restore normal resistance in a superconductor either by the application of a magnetic field or by passing a large current through the superconducting circuit. The resistance was a non-linear function of field or current, and this non-linearity was the basis of the two-state superconducting computer devices described.

The cryotron was essentially a superconducting relay, using a small solenoid to control the resistance of a superconducting " gate " wire. It possessed current gain since the control current required was less than the current it was capable of controlling, and it would be used in logical networks without additional amplifiers. In its original form it was not very fast, the time required to switch a pair of cryotrons being about 100 $\mu$sec, but in a new type based on thin evaporated superconducting films a much greater speed had been attained.

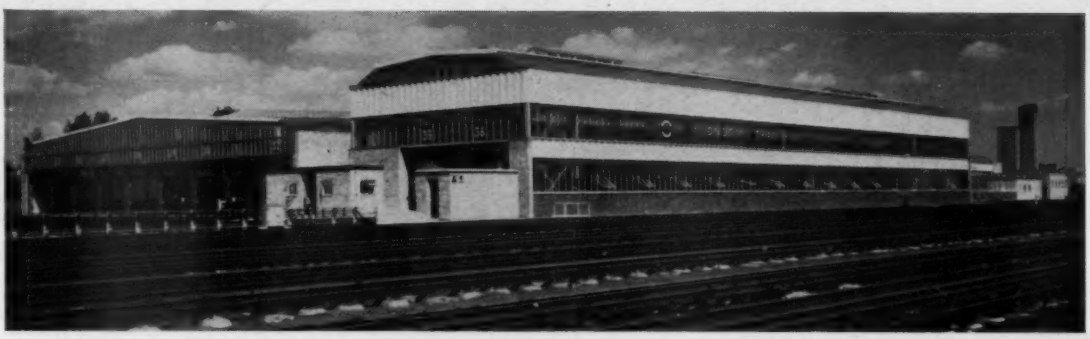
An even more promising device was the Crowe cell, using persistent currents in a thin evaporated film for the storage of information. This device might revolutionise the construction of the large " store " required in any big computer, since it was capable of switching in 10 m$\mu$sec, about 100 times faster than the present ferrite core memory element. Future computers might be based on a " store " of more than a million Crowe cells, working in conjunction with semiconducting logical elements such as the transistor, cooled to liquid helium temperature, and capable of an operation rate of 100 Mc/s.

## Young People's Programme

One of the features of the meeting was the programme for students of schools in the York area. Augmenting a series of illustrated lectures was an exhibition of science in schools, with over 40 schools contributing, and an open forum in which questions submitted by senior students were answered by a panel of scientists.

In a lecture by Mr. P. D. Potter on the peaceful uses of atomic energy, a film, " Conquest of the Atom," explained the physical principles underlying the uses of atomic energy and their application to nuclear power reactors of both the fission and fusion types. The industrial, agricultural and medical uses of isotopes were discussed and demonstrated.

The development of large computing machines and their use in such applications as industrial design was described in a lecture given by Dr. A. D. Booth, who indicated how machines could be made to simulate human thought.



*London Transport's Upminster railway depot*

# London Transport Railway Depot

THE new Upminster (District Line) depot of London Transport has now been brought into full service. It is the first completely new Underground Railway depot to be built since the war and has cost £1 million; it will take 34 eight-car trains. Among its special features are a shunting control tower fitted with talk-back apparatus, enabling instructions to be given from the tower to drivers through trackside loudspeakers heard by the driver concerned and no one else, and microphones enabling the driver to reply, using ordinary speech level; complete control of all points by thumb switches in the control tower; and two train-washing machines of a new type. Associated with the opening of this depot, a new pushbutton signal cabin was brought into use at Upminster Station.

The new depot has three reception roads leading to 13 sidings capable of taking 25 trains, a car shed with nine roads, a lifting shop with two roads, and three permanent way sidings. There are washing machines on two of the reception roads, and all roads in the car shed and lifting shop have pits.

The 450ft-long car examination shed consists of nine roads, eight of full length capable of taking an eight-car train completely over the pits, and a short pitted road taking three cars. As the work is mainly cleaning and examination and not detailed inspection one pit road only is provided with side pits.

*Upminster station signal box, showing signalman's control console, with internally-illuminated pushbuttons and illuminated track diagram*

Overhead conductors, carrying small trolleys with jumper cables to provide power to trains, run the full length of the pits. The connectors on the jumper cables are inserted into receptacle boxes on the cars when power is required. This is the standard practice at London Transport depots. The shed is provided with pit heating, an innovation at rolling stock depots. The lifting shop, adjoining the examination shed, is 215ft long. It is served by an overhead 15-ton travelling crane supplied and installed by the Wharton Crane & Hoist Co., Ltd.

Apart from the main depot buildings, there is a new substation which is of the unmanned type and provides power for the various electrical services in the depot.

The supply is brought in at 11 kV over a duplicate cable circuit and connects to the h.v. switchboard via truck-type

*Shunter's console in the control tower, showing the track diagram with geographically mounted thumb switches for point operation and buttons for individual switching-in of talk-back loudspeakers. The microphone used by the shunter can be seen on the left of the panel*

oil circuit-breakers rated at 250 MVA. Truck-type breakers of the same rating distribute the supply to the various equipments. Metering and protection equipment associated with the h.v. board are mounted on a separate panel. The 630 V d.c. supplies for traction and other purposes are provided by two 12-phase steel tank mercury arc rectifier units, each rated at 1,500 kW.

Each complete 12-phase 1,500 kW unit consists of two separate self-contained 750 kW half-units, each comprising a six-phase 750 kW, Class III fan-cooled rectifier

fed from a three-/six-phase 11 kV/582 V transformer cooled on the air-to-air principle by a closed air circuit cooling system.

Supplies for lighting, heating and other a.c. services are given from an 11 kV/415 V, 500 kVA oil-cooled outdoor transformer. Current for signalling is delivered at 33⅓ c/s single-phase from two motor-generator sets, one of which acts as standby. Two supplies are given, one at 440 V for track-circuiting equipment and one at 600 V for signal circuits. Two lead-acid batteries, complete with chargers, are provided, giving supplies at 110 V d.c. for switchgear-closing purposes and 50 V d.c. for switchgear tripping.

## Restrictive Trade Practices

THE extent to which the Restrictive Trade Practices Act is achieving its purpose is indicated by figures given in an address by the Registrar to the British Association.

At the beginning of August there were 2,200 agreements on the register. The parties to 380 of them had been warned that the Registrar intended to start proceedings and as a result 250 agreements had been abandoned or were being abandoned. The parties to another 350 "unwarned" agreements had also abandoned or were abandoning them, making over 600 abandoned in all.

Six cases had come to trial. This figure would have been much higher if the parties to many agreements had not decided (sometimes when the case was nearly ready for trial) to end rather than defend them. The Registrar expected that a high proportion of the 130 cases in which proceedings were now pending would not come to trial. For example, in April and May, he had sent warning letters to the parties to 100 agreements and 60 of these had already been abandoned.

There were 1,450 agreements on which no action had yet been taken, but over 1,050 were closely connected with cases already started. A single judgment by the Court might affect as many as 100 of these agreements and could often settle a dozen or more. Of the other 400 agreements, as many as 200 might qualify for removal from the register under Section 12 of the Act as being of no substantial economic significance. Action on these would take time, since the Registrar had to consider their practical effects as well as their formal content. The last 200 consisted mainly of newly registered agreements, old ones which should have been registered earlier, and some involving formidable problems of registration.

## TRADES UNION CONGRESS

ADDRESSING the Trades Union Congress at Blackpool, Mr. Robert Willis, the president, said that the country was entering the first phase of a second industrial revolution. In the first, mechanical labour replaced to a large extent hand labour and brought in its train economic misery and suffering to vast masses of workers in every field of industry. In this, the second, industrial revolution the tendency was towards the devaluation of the human brain in its simple and more routine decisions. Automation and electronics mechanised the thought processes as earlier processes mechanised hand operations. These changing methods demanded from industry, and particularly from the trade unions, a revision of ideas on industrial relations.

Mr. Willis spoke of the need for a fuel and power policy. "It might well be," he said, "that had the Government followed the advice tendered by the Trades Union Congress and set out to co-ordinate the fuel policy of this country, taking into consideration electricity, gas, coal and oil and combining these great forces for man's advancement in man's interest, the hardships that are now being envisaged might have been avoided. A full inquiry into the sources and use of fuel and power is called for.

Concern at present fuel and power policy was expressed in a motion of the National Union of Mineworkers. It considered that measures to alleviate the position should include (1) a general economic and financial policy by the Government aimed at securing the expansion of the national economy and full employment; (2) the setting up of a consultative body, including representatives of the gas, coal, electricity and atomic energy industries, to secure greater operational and developmental co-ordination, as recommended by the Ridley Committee, within which a planned fuel policy should operate; (3) the acceleration of research and the development of new forms of coal utilisation; (4) the securing of maximum efficiency in coal distribution.

A composite motion opposing any form of wage restraint was moved by Mr. R. G. McLennan, of the Electrical Trades Union. He argued that wage increases could be met out of the increased profits now being made. The motion was carried by an overwhelming majority.

Other motions carried during the week included one from the National Union of Railwaymen, which called upon the General Council and the Labour Party to examine the need for closer working among the nationalised industries. It wanted a co-ordinated policy in the interests of public ownership and the nation.

## Cable & Wireless Report

RESPONSIBILITY for financing, laying and maintaining the United Kingdom's share (approximatetly half) in the £80 million Commonwealth round-the-world telephone cable system has been assigned to Cable & Wireless, Ltd. This decision, and a new working partnership with the Post Office designed to harness the resources of the two organisations in the interests of Commonwealth communications, are announced by Sir Godfrey Ince, chairman of Cable & Wireless, Ltd., in the company's report and accounts for the year ended 31st March last, published as a White Paper (H.M. Stationery Office, 1s 3d net).

The Post Office will have the main responsibility for designing and engineering the telephone cables as far as the United Kingdom is concerned, the company contributing, apart from finance, its world-wide organisation of stations and cableships, which will ensure the integration of the new network with its submarine telegraph system and other overseas telecommunications facilities.

The partnership arrangements provide also for the establishment of a joint Submarine Cable and Repeater Development Unit, which will serve both the company and the Post Office. Engineers of the company will form part of it, and the company will share in the cost. The Development Unit will be controlled by Mr. R. J. Halsey, director of research in the Post Office Engineering Department, who was elected a director of Cable & Wireless, Ltd., at the annual general meeting on 29th July. He will speak for the United Kingdom on technical matters at Commonwealth and international conferences connected with telephone cables.

The accounts show a total revenue of £15,791,766, as compared with £14,417,080 for the preceding year, and after meeting all charges, but before taxation, the profit is £1,061,095 higher at £3,366,981. The following appropriations have been made:—Taxation, £1,624,500; equalisation of United Kingdom taxation relating to earlier years, £150,000; appropriation against cost of investments in British Government and other securities, £250,000; staff pensions, £300,000; general reserve, £250,000; dividend of 4 per cent (unchanged), £735,000. The balance carried forward is £669,181 (against £611,700 brought in).

### I.E.E. Presidential Address

IN view of the choice of Thursday, 8th October, as polling day for the General Election, arrangements have been made for the inaugural address by the President of the Institution of Electrical Engineers, Sir Willis Jackson, previously arranged for that day, to take place instead on Friday, 9th October, at 5.30 p.m.

# GENERATION and DEVELOPMENT

### *Domestic Appliance Sales*

The accompanying return issued by the Electricity Council shows the number of new appliances sold by Area Boards in England and Wales for

| | Month ended 31st July | | Twelve months ended 31st July | |
|---|---|---|---|---|
| | Total | Change % | Total | Change % |
| Cookers ... | 28,042 | + 41·5 | 322,602 | + 41·6 |
| Water Heaters: | | | | |
| Immersion... | 24,988 | + 21·0 | 184,385 | + 19·8 |
| Storage ... | 4,965 | + 21·8 | 57,033 | + 29·7 |
| Wash Boilers... | 5,583 | − 17·2 | 73,662 | − 7·9 |
| Washing Machines ... | 12,958 | + 93·2 | 154,889 | +107·2 |
| Refrigerators | 29,277 | +181·6 | 146,022 | +150·0 |

the month of July and for the twelve months ended 31st July, 1959, together with percentage changes over corresponding periods of the previous year. It will be seen that refrigerator sales were again at a high level.

### *Tyne Crossing*

Jarrow-on-Tyne has given further consideration to the proposed construction of a high voltage overhead cable across the Tyne between Jarrow and Howdon. It has been suggested by the Council that as work is due to start next year on a Tyne tunnel connecting the two towns, the Central Electricity Generating Board should investigate the possibility of laying the cable in the tunnel.

### *Douglas Engineer's Report*

In his report for 1958-59 Mr. C. Anderson, M.I.E.E., borough electrical engineer and manager of Douglas, I.O.M., shows that sales in the Corporation's supply area rose by 5·6 per cent to 26·5 million kWh. In addition, 0·6 million kWh was sold for public lighting and there were exchanges of power with the Isle of Man Electricity Board. Sales per consumer rose from 2,570 to 2,707 kWh and per head of the population from 1,002 to 1,060 kWh. The number of consumers at the end of March last was 9,791. Income for the year amounted to £318,419 and working expenses were £216,315. After meeting loan charges, etc., a sum of £3,724 has been transferred to the reserve fund. The average price obtained per kWh sold (Douglas area) was 2·505d, against 2·525d in the previous year.

### *Longer Trains on the Circle Line*

London Transport states that a start has been made on its plan to lengthen all Circle Line trains. Fourteen trains are employed in the service and the first of these has just been lengthened from five to six cars.

## OVERSEAS

### *Higher Charges Affect Sales*

Increased tariffs had a noticeable effect on the operations of the Christchurch (New Zealand) Electricity Department in 1958-59. The substantial nature of the increases is shown by the fact that the cost of bulk power was 50 per cent more than in the previous year (£1,444,000 against £948,000). Revenue had to be procured to match not only this figure but also increases in almost every other item of expenditure. As a result of tariff revisions, income rose by £707,700 to £2,220,400, though energy sales were only 3·6 per cent higher at 389·8 million kWh (the average rate of expansion in the two preceding years was 9·4 per cent). Load control of water heating, and to some extent the abnormally mild weather, helped to keep down the maximum demand, resulting in a slight improvement in load factor at 47·9 per cent. In his report the engineer-manager, Mr. G. H. Battersby, B.Sc., M.I.E.E., says that this improvement was smaller than anticipated but it is believed that ultimately an annual load factor of 50 per cent can be achieved.

### *Power from Wairakei*

The first low-pressure turbine at the Wairakei geothermal power station is now feeding electricity into the New Zealand grid. It is the station's third turbine to produce power. With a maximum output of 11,200 kW, the set is the largest of the initial three turbines. It is hoped that the fourth turbine will be operating in a month or two. This would mean an output of 35,400 kW, half the capacity of the first stage.

### *New Power Station in Sarawak*

A new power station designed to meet the growing demand for electricity in the Kuching area of Sarawak for the next ten years is now in initial operation. It has been designed to enable the existing station in the centre of Kuching and one station outside the capital to be closed down; a network of overhead lines and underground cables has been laid to connect them with Sungei Priok.

When complete the new station will have eight 1,350 kW sets.

### *Owen Falls Power Station*

During August the eighth 15 MW set was commissioned at the Owen Falls power station, Uganda, bringing the total installed capacity up to 120 MW. The power station will eventually house ten 15 MW sets.

### *Water Power in Tanganyika*

The Dar-es-Salaam correspondent of *The Times* reports that officials of the Food and Agriculture Organisation of the United Nations who have nearly completed a five-year survey of the Rufiji basin in Tanganyika believe that "a second Kariba" could be established there. The main dam would be at Stiegler's Gorge, where the Rufiji passes between 400ft rocky cliffs about 120 miles from the sea. The development of the entire basin would cost £80-£100 million.

### *Transformers for Hong Kong*

To meet the rapidly growing needs of Hong Kong's Central District, the Hong Kong Electric Co., Ltd., is installing four new 10,000 kVA transformers. Three of these new units, shipped from the G.E.C. works at Witton, have already been housed in the district's substation.

Installing the new transformers needed considerable skill because the substation is situated on the side of a steep hill, and can only be approached through narrow streets fringed with commercial warehouses.

*Greenock Service Centre of the South of Scotland Electricity Board. The building is heated by a floor warming system*

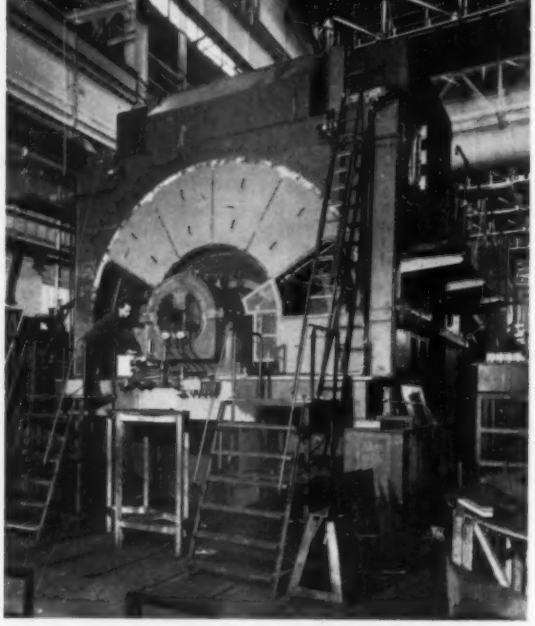
# INDUSTRIAL NEWS

## Lamp Price Changes

The following lamp manufacturers have announced reductions in the prices of general purpose and general lighting service lamps. The reductions range up to about 25 per cent:—A.E.I. Lamp & Lighting Co., Ltd; Atlas Lighting, Ltd.; Ekco-Ensign Electric, Ltd.; Crompton Parkinson, Ltd.; General Electric Co., Ltd.; Philips Electrical, Ltd.; Stella Lamp Co., Ltd.; Siemens Edison Swan, Ltd. Increases in the prices of certain special purpose lamps are announced by Philips Electrical, Ltd., Atlas Lighting, Ltd., Ekco-Ensign Electric, Ltd., Crompton Parkinson, Ltd., and the General Electric Co., Ltd.

## Turbo-Electric Liner

Manufacture of the propulsion equipment for the 45,000 ton turbo-electric ship *Canberra* which is being built by Harland & Wolff, Ltd., for the P. & O. Steam Navigation Co., is well advanced. The accompanying photograph shows the forward end of the 42,500 s.h.p., 147 r.p.m. double-unit closed-air circuit port propulsion motor which is being dismantled for shipment after official tests in the Rugby Works of the British Thomson-Houston Co., Ltd. (management company of the A.E.I. Heavy Plant Division). On top of the stator frame is the ventilating system which includes sea water circulated air coolers and motor-driven fans. Driven from the shaft end are a selsyn transmitter for propeller rotation indication, etc., two-speed switches for controlling jacking oil pumps, and a tacho-generator.



*Port propulsion motor for the "Canberra"*

## B.E.A.M.A. Publicity Conference

As we have already reported, the fourth annual Publicity Conference organised by the British Electrical and Allied Manufacturers' Association is being held at the Connaught Rooms, London, W.C.2, on 3rd and 4th November under the chairmanship of Mr. C. T. M. Bagnall (English Electric Co.). There will be six sessions and the following subjects are included in the programme:—"Industrial Photography," "The Rôle of House Magazines in Industry," "Editorial Publicity," "Ride Your Hobby Horse," "Exhibitions—A Critical Survey" and "Publicity Overseas." At the conference luncheon the guest speaker will be Col. B. H. Leeson, C.B.E.

## Domestic Appliances Selling Campaign

Edmundsons Electrical Wholesalers, Ltd., last week launched a selling campaign in London when a number of domestic electrical appliances, new to this country, were introduced for the first time. The opening of the campaign took the form of an exhibition at the Park Lane Hotel where nearly thirty items, from Italy, Switzerland, Holland, Luxembourg and this country, were on show. They included a portable 1·2 cu ft battery/mains refrigerator which weighs only 30 lb and is suitable for operation on any voltage from 12 to 250. Another item of interest was the "Lindex" combined washing machine and spin dryer. The machine does not use agitator blades or pressure jets of water but has an action identical with that adopted for hand-washing. An electric cooker utilising infra-red rays was also on view, as well as table-top infra-red grills and a combined coffee grinder and food mixer.

Among the smaller items were electrically heated carpets and foot mats, as well as foot muffs in a variety of cloths and patterns. Another novel appliance was a fabric plate warmer. Not unlike an electric blanket or quilt in appearance, it is designed to accommodate up to ten plates at a time. In use, the plate warmer is folded in a zig-zag manner, the plates being placed in each fold where they are warmed and kept at the right temperature for serving food.

Vacuum cleaners and floor polishers and electric hair dryers, one of which has an unbreakable nylon casing, and a dish washer which will sell for under £70 including tax, were also exhibited.

It is understood that Edmundsons are training their own demonstrators, who will be put at the disposal of retailers, and will also employ representatives and home demonstrators who will refer inquiries back to the local retailer in each area. Further exhibitions of a similar nature are to be staged at Cardiff, Manchester, Leicester, Birmingham and Bristol during the next month.

*Combined plug and cable assembly developed for installation in multiple unit diesel trains by Modern Acoustics, Ltd., to supply power for the heater fan motor and heater controls. The cable is moulded to the connector for robustness and weatherproofing. The connector is of the multi-contact type, each plug contact blade being gripped by a series of spring banks*

## Anglo-American Controls Company

A new Anglo-American venture to design and manufacture automatic control systems for industry, Hagan Controls, Ltd., has been initiated by the Plessey Co., Ltd., Ilford, and Hagan Chemicals & Controls, Inc., Pittsburgh, Penn., U.S.A. The Plessey Co. holds 90 per cent of the shares in the new company which is to begin operations at Ilford immediately. It will have the manufacturing and selling rights for the entire range of Hagan automatic control equipment for the maintenance of physical conditions within given tolerances, and Kybernetes data processing equipment in Great Britain and the Common-

wealth except Canada. The directors are Messrs. A. G. Clark (chairman), M. W. Clark, E. J. Earnshaw, C. D. H. Webb, Denis Taylor, W. W. Hopwood (U.S.A.), M. J. Boho (U.S.A.) and C. W. Sengstaken (U.S.A.).

### Atlas Lighting Convention

Over 150 wholesalers and Atlas sales staff attended the opening conference of the Atlas Lighting, Ltd., convention programme on 8th September at Thorn House, Upper St. Martin's Lane, W.C.2. Mr. J. G. Christopher, director and general sales manager, announced that this was the first of the most extensive series of conventions ever launched by the company. After the conference delegates toured the building and inspected the new showrooms. At the conferences in twelve provincial cities Atlas representatives and wholesale distributors will see Atlas Lighting equipment and "Broccoli Towers," a light-hearted sound and light presentation using "Aurama," the automatic sound and light control system first developed for this year's A.S.E.E. Exhibition. The programme in each of the twelve provincial towns will last two days. Trade architects, consulting engineers and users are invited and tickets are available from all Atlas area offices and representatives.

### Domestic Refrigerator Sales

The Electrical Division of Radiation, Ltd., has joined the Domestic Refrigeration Development Committee ("Dordec"). The total sales of domestic refrigerators for 1958 were double those of any previous year. In 1959 the sales to the end of July had already outstripped the sales for the whole of 1958.

### P.V.C. Booklet

An illustrated 40-page publication issued by British Geon, Ltd., gives a brief description of the processes involved in the production and use of p.v.c. One of the major fields is the use of p.v.c. in the sheathing and insulation of cables and wires. Copies of the booklet, "The Geon Story," are available free on request from the Information Department of the company at Devonshire House, Piccadilly, London, W.1.

*What must surely be one of the largest lighting "fittings" ever made is the one illustrated. It is a chandelier with nine groups of lamps which is being installed in the Grand Palais for the Paris Automobile Show next month*

### Plant Engineers' Refresher Course

The Education Committee of the Institution of Plant Engineers announces that its next refresher course for senior works and plant engineers is to be held this winter at Leeds University. It will consist of eighteen weekly lectures on Thursday evenings, commencing on 29th October. The fee for the course is four guineas and copies of the syllabus and full particulars can be obtained from the secretary to the refresher course, Department of Engineering, the University, Leeds, 2.

### Guide to "The Seven"

The speed with which the negotiations for a Free Trade Association of the "Outer Seven" countries have proceeded has made it difficult for many people to follow them and understand what is involved. They will find much help in a new booklet, "The Seven" (Chamber of Commerce Publications, 68, Great Queen Street, London, E.C.4, price 2s 6d), which, after outlining the reasons for the failure of the earlier attempt to form a European Free Trade Area, traces the course of the present discussions. The provisions of the Stockholm draft plan are summarised and there are some useful statistics on the trade of each participating country and details of their customs tariffs.

### Football Ground Floodlighting

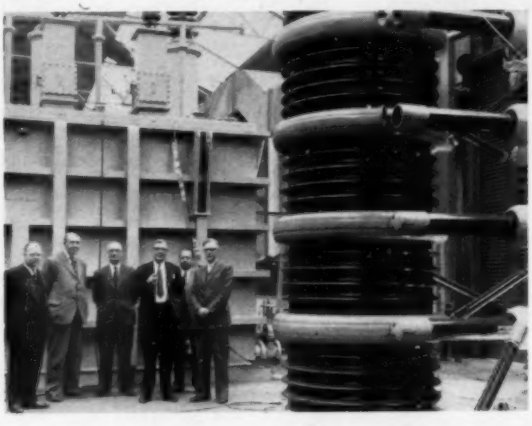
A new G.E.C. floodlighting system has been installed at the Bristol Rovers Football Club ground. Four clusters of 36 F.69057 floodlights, made of copper, are mounted on 135ft towers with portal bases. Each floodlight houses one 1,500 W "Osram" lamp. The floodlights are operated by four dimmer banks, separately controlled by pushbutton contactors, thus allowing the illumination level to be decreased whilst the spectators are assembling. When the dimmer banks are shorted-out by means of the contactors, the illumination on the pitch is increased about three times. Clough, Smith & Co., Ltd., supplied and erected the towers and the electrical installation was carried out by Colston Electrical Co., Ltd. Over 30 professional football club grounds, including Chelsea, Manchester United and West Ham, are now equipped with floodlighting provided by the General Electric Co., Ltd.

### Industrial Efficiency and Safety Exhibition

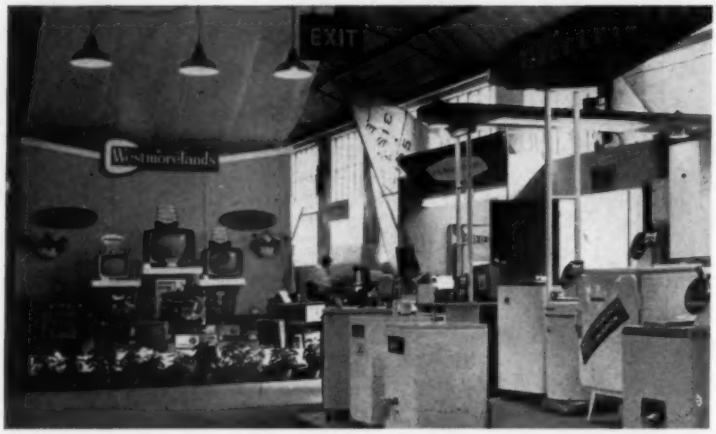
Sponsored by the Institution of Works Managers and organised by Provincial Exhibitions, Ltd., the Industrial Efficiency and Safety Exhibition will be held from 3rd to 14th November at the City Hall, Deansgate, Manchester.

### Telecommunication Symbols

The sixth supplement to the British Standard covering graphical symbols for telecommunications, B.S. 530: 1948, deals with the Services' preferences and was produced at the Services' request (through the Electronics Glossary and Symbols Panel of the Joint Electronics Standardisation



*A 45 MVA 132/32 kV transformer on completion of an impulse test at the Dewsbury Works of the Yorkshire Electric Transformer Co., Ltd. The transformer is destined for the Tamworth power station of the C.E.G.B., and the group in the picture shows (left to right), Messrs. G. B. Harper (C.E.G.B.), and A. J. Gibbons, J. Lord, J. Laughton, F. B. Lydall and J. Bennett of the Yorkshire Electric Transformer Co.*




*A view of some of the electrical stands at the East Midlands and Leicester Home Life Exhibition which opened last week at the Granby Halls, Leicester, and ends tomorrow (Saturday)*

Committee). It will meet the needs of the many users of that standard who are either in the Services or connected with the supply of equipment to them. Certain symbols additional to those given in B.S. 530 and the first five supplements are included and it indicates Services' preferences concerning alternative symbols, as well as depicting a few deviations from B.S. 530 which the Services find necessary.

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 3s.

### Precision Bearings News Sheet

We have received from Quality Bearings, Ltd., 218-221, Bedford Avenue, Slough, Bucks., a copy of its first issue of "Beta," a news sheet introduced to serve the interests of users of precision bearings. This issue is devoted to an article by Mr. T. E. Rounds, of the Barden Corporation of America, on "Torque and Torque Testing of Instrument Ball Bearings."

### Contract Price Adjustment

In giving the latest figures for the B.E.A.M.A. contract price adjustment formulæ in our issue of 28th August (p. 132) an error occurred in the index figure for "other steel goods, excluding tubes." This should have been 128·6 (provisional).

### Railway Telephone Exchange

A new private automatic branch telephone exchange recently brought into use at the York headquarters of British Railways North Eastern Region is a preparatory step towards "on demand" subscriber trunk dialling throughout the region and later throughout British Railways. The exchange has a capacity of 1,200 subscriber lines served by the standard three-stage switching, comprising 380 first stage, 170 second stage and 300 final stage switches. The initial trunk network is made up of 30 lines to the G.P.O. network, 21 ordinary railway trunks, nine voice frequency dialling trunks and 10 railway omnibus circuits. Access to these trunks is via a seven-position manual switchboard. The switching and associated v.f. equipment for the exchange, which replaces a 310-line exchange installed some 25 years ago, has been manufactured by the Automatic Telephone & Electric Co., Ltd., and supplied through Communications Systems, Ltd., a member of the A.T.E. group.

### Diesel-electric Tug

A new 114ft-long tug for handling large tankers at the Cardon oil refinery in South America has recently been constructed for the Shell Co. of Venezuela. Diesel-electric main and auxiliary machinery, supplied by the Metropolitan-Vickers Electrical Co., Ltd., has been installed to provide a wide range of operational characteristics, with speeds up to 12·75 knots and a bollard pull up to 15 tons. The two main generators, which are driven by Mirrlees diesel engines, are rated at 420 kW at 750 r.p.m. and are force ventilated from the engine room supply fans. The generators are separately excited by a metadyne and develop a constant current of 700 A under all conditions of load at a voltage between 0 and 600 V dependent on the load value. The forced ventilated propulsion motor is of the double armature type, capable of developing 1,000 s.h.p.

The tandem driven auxiliary generators which supply the 110 V d.c. equipment on board are each of 60 kW rating and a 40 kW harbour duty generating set has also been supplied. Two exciter sets are provided, one standby, each consisting of a driving motor, generator metadyne exciter, propulsion motor metadyne exciter, 220 V d.c. exciter, stabilising transformer and resistances.

Four fire fighting monitors have been fitted, capable of discharging water at a rate of 3,300 gal/min at a pressure of 150 p.s.i. The monitors are supplied by two pumps driven by 225 h.p. motors separately excited from the 110 V d.c. supply. For slow speed manœuvring, a Pleuger activated rudder is fitted, having a propeller driven by a 100 h.p. motor. Power for this motor is supplied from an alternator driven by a Rolls Royce diesel engine.

A constant power characteristic for the propulsion motor is achieved by connecting the generators, propulsion and pump motors and generator metadyne control fields in series in a main loop circuit carrying a constant current of 700 A. Switches are provided to enable any portion of the circuit to be isolated and short circuiting contactors are fitted to each propulsion motor in order to protect the commutator during periods of rest and to give dynamic braking in a tideway.

Other advantages offered by this system include the "ahead" or "astern" control of the propulsion motor by varying its field current in strength and direction, and the ability to use the propulsion and fire-pump motors with only one main generator in circuit.

*Firefighting monitors operating during the tug's trials*

### E.A.W. Electrical Housecraft Certificates

At the 45th E.A.W. examination for demonstrators and saleswomen 143 candidates gained the electrical housecraft certificate, 15 with distinction. The total number of certificate holders is now 3,179. At the 42nd examination for teachers 52 candidates were successful, one with distinction. 2,351 teachers now hold the certificate.

### Electrical Commercial Travellers

The annual ball of the Electrical Trades' Commercial Travellers' Association will be held on 2nd October (7 p.m.) at the Park Lane Hotel,

Piccadilly, London, W.1. Applications for tickets (47s 6d each) should be made to Mr. F. J. E. Simons, social secretary, 42, Lower Barn Road, Purley (telephone: Uplands 6078).

### Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

| | |
|---|---|
| ALUMINIUM ingots | ton £180 0s 0d |
| COPPER, H.C. Electro | ton £227 10s 0d |
| Fire Refined 99·70% | ton £226 0s 0d |
| Fire Refined 99·50% | ton £225 0s 0d |
| COPPER Tubes .. | lb 2s 2½d |
| Sheet .. .. | ton £259 5s 0d |
| H.C. wire and strip .. | ton £283 5s 0d |
| LEAD, English .. | ton £70 10s 0d |
| Foreign .. .. | ton £69 0s 0d |
| MERCURY .. .. | flask £71 10s 0d |
| TIN, block (English) .. | ton £793 10s 0d |
| ZINC, G.O.B. Foreign | ton £86 5s 0d |
| BRASS Tubes (solid drawn) .. .. | lb 1s 10½d |
| Wire .. .. .. | lb 2s 7½d |
| PHOSPHOR BRONZE Wire .. .. .. | lb 4s 0½d |
| PLATINUM .. .. | oz £28 10s 0d |
| RUBBER, No. 1 R.S.S. spot .. .. .. | lb 32d—33d |

### British-Swedish Marketing Conference

The Federation of British Industries and the British-Swedish Chamber of Commerce are organising a joint conference, to be held in London on Wednesday next, to discuss ways of expanding Anglo-Swedish trade. The director-general of the F.B.I., Sir Norman Kipping, will open the conference and Mr. Nils Danielson, president of the British-Swedish Chamber, will sum up. Among the matters which will be discussed by leading Swedish importers will be the scope for stepping up exports of particular classes of British goods, including hardware, electrical equipment, motor accessories, textiles and chemicals. Over 120 British firms and trade associations will be represented at the conference.

### Change of Address

Frederick S. Snow & Partners, consulting engineers, inform us that their new office building, Ross House, 144, Southwark Street, London, S.E.1, will be ready for occupation on 12th October, and from that date their eight offices in the London, W.C.2, area will be centralised at that address.

### Birmingham Fuel Forum

The fuel policy of industrial firms is no longer dictated by availability of supply, but rather by considerations of cost and production efficiency, coupled with the need to meet the requirements of the Clean Air Act. To help industrialists with small or medium-sized boiler plant, either coal or oil-fired, to solve their problems, the Combustion Engineering Association is holding a forum at the Queen's Hotel, Birmingham, on Thursday, 15th October, beginning at 10 a.m. At this forum a panel of experts will answer questions from industrial fuel users and others, who will also be invited to contribute their own views. It is anticipated that the problems discussed will include the choice of fuel, the selection of plant, cutting the cost of operation and increasing productivity, the training of personnel, reliability of plant and meeting the requirements of the Clean Air Act. The forum is open to non-members of the Association and those wishing to attend should apply to the Director of the Combustion Engineering Association, 70, Jermyn Street, London, S.W.1, for full details.

### Trade Announcements

On Monday next **Ferodo, Ltd.**, is opening new premises at 3, Condercum Road, Newcastle-on-Tyne, 4 (telephone: Newcastle-on-Tyne 39131/2). These premises replace the accommodation in Barras Buildings which the company has occupied in the city for the past twenty-four years.

**Brown Brothers, Ltd.**, have transferred their Leeds branch to new premises in Regent Street, Leeds, 2 (telephone: Leeds 30481). The new premises have a floor area of about 30,000 sq ft and sales counters for radio and electrical goods are on the first floor.

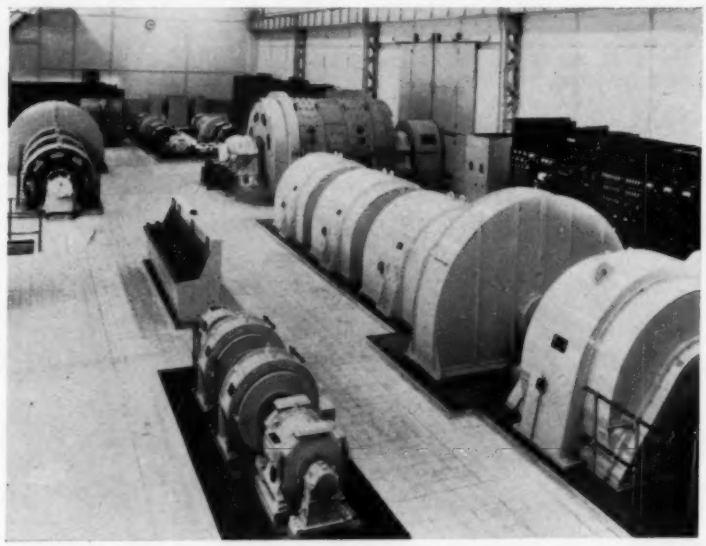
The **Minnesota Mining & Manufacturing Co., Ltd.**, has transferred its Manchester regional office to 3M House, Corporation Street, Manchester, 4 (telephone: Deansgate 8571).

**Lee Products (Gt. Britain), Ltd.**, has taken over the Dulci Co. It will continue to produce existing Dulci lines at the Dulci factory at Willesden.

## Corby Works Reconstruction

A reconstruction carried out by Stewarts & Lloyds, Ltd., in their Corby works involved the replacement of a 42in primary mill by a 48in mill of greater ingot rolling capacity. An existing spare motor for the 42in mill was found to be suitable for the 48in mill. A new motor-generator set, however, was ordered from the Metropolitan-Vickers Electrical Co., Ltd., and has now been installed. It is of conventional flywheel design with amplidyne excitation for the generators and mill motor. It comprises three 2,000 kW d.c. generators driven by an 11 kV, 5,000 h.p., 600 r.p.m. slip-ring induction motor with a 35 ton flywheel. All auxiliary drives in the mill are powered by forced-ventilated, standard mill-type motors supplied from two amplidyne-excited Ward-Leonard motor-generator sets.

The screwdowns on this mill are controlled from two automatic programmers—one supplied by the Digital Engineering Co., Ltd., and the other by Metropolitan-Vickers. The latter programmer uses standard teleprinter-type punched paper tape and is arranged to provide any one of fifty rolling schedules at the turn of a switch. A greater number of programmes could be catered for, but fifty is considered sufficient in this particular case. The remote-position servo for both programmers was supplied by Metropolitan-Vickers and uses 50 c/s flux-resetting amplifiers.



*General view of 48in mill motor room at Stewarts & Lloyds, Corby, showing the 7,500 h.p. main motor and associated motor-generator set, exciter sets and control gear. This mill has automatic programmed position-controlled screwdowns*

# PERSONAL AND SOCIAL

## *News of Men and Women of the Industry*

In our last issue we reported that on 31st December next **Lt.-Col. H. Riggall** is relinquishing the position of managing director of Ruston & Hornsby, Ltd., and that he will continue his association with the company as deputy chairman. As we reported,

*Lt.-Col. H. Riggall*

*Mr. V. R. Prehn*

*Mr. G. W. Bone*

**Mr. V. R. Prehn** and **Mr. G. W. Bone** will become joint managing directors on 1st January. We have since received the portraits of these three gentlemen which we now reproduce.

As we report elsewhere in this issue, **Mr. R. J. Halsey,** C.M.G., B.Sc.(Eng.), F.C.G.I., D.I.C., M.I.E.E., director of research in the Post Office Engineering Department, is to control the joint Submarine Cable and Repeater Development Unit, which is being established by Cable & Wireless, Ltd., and the Post Office, and he has been elected a director of Cable & Wireless, Ltd. He will combine these new duties with his present work for the Post Office.

**Mr. S. N. Bourne,** of the Control Gear Engineering Department, A.E.I. Motor and Control Gear Division, has retired after forty-seven years' service with the British Thomson-Houston Co., Ltd. He was recently presented with parting gifts by Mr. J. G. Boddy, divisional general manager. Mr. Bourne joined the B.T.H. Co. in 1912 as an apprentice in the Test Department. After military service in the 1914-18 war, he re-joined the B.T.H. Co. and served from 1919 to 1922 in the Electrical Construction Department and then transferred to the Control Gear Engineering Department. In the last war he served as an engineer officer, R.A.F., in charge of repair depots in this country, and in India, and was demobilised with the rank of squadron leader. Returning to the company he rejoined the Control Gear Engineering Department where he continued until his retirement.

The development branch of the Mond Nickel Co.'s Development and Research Department has recently been reorganised into four divisions under the general managership of **Mr. F. Dickinson,** a director of the company. The divisions are as follows:—Ferrous Division (manager, Mr. W. W. Braidwood); Non-Ferrous Division (manager, Mr. J. Hinde); Applicational Engineering Division (manager, Dr. A. B. Everest); and General Division (including Plating, Chemical Products and Nuclear Power) (manager, Dr. E. C. Rhodes). **Mr. L. W. Johnson,** at present assistant manager of the department, having reached retirement age, will relinquish his appointment at the end of this month.

**Mr. J. R. V. Dolphin,** C.B.E., has been appointed a joint managing director of Lansing Bagnall, Ltd., with **Mr. V. A. G. Lambert.** Mr. Dolphin is at present chief engineer of the Research Group of the United Kingdom Atomic Energy Authority. **Mr. P. Boulton,** general manager of Lansing Bagnall, has been appointed to the board of the company. **Mr. E. Kaye** and **Mr. J. Sharp** remain governing directors.

The Pressed Steel Co. announces the appointment of **Mr. D. A. Field** as sales director for the United Kingdom of the Prestcold Division. Mr. Field joined Refrigeration (Birmingham), Ltd., in 1946 and became sales manager in 1949, being appointed a director in 1951 and managing director in the same year. He continued in this latter post when the Pressed Steel Co. acquired control of Refrigeration (Birmingham) in 1958, which was subsequently renamed Prestcold (Midlands), Ltd., a position he will continue to hold in addition to his new responsibilities.

*Mr. D. A. Field*

The Simplex Electric Co., Ltd., informs us that the new senior project engineer of the Simplex Division is **Mr. P. C. Mortimore,** O.B.E., not "Morimore" as printed in our last issue.

A number of changes in E.I.B.A. branch officers are announced. **Mr. H. A. Dow** (Dow & Nicholson, electrical contractors, of Aberdeen) has been appointed chairman of the Aberdeen and District Branch in succession to **Mr. J. E. Whittaker. Mr. F. P. Phillips,** A.M.I.E.E., B.Sc. (Engineers' Branch, Port of Bristol Authority), has been appointed chairman of the Bristol Branch in succession to **Mr. A. C. Jones. Mr. C. J. Hocking,** M.I.E.E. (group adviser, South Western Electricity Board, Redruth) has been appointed chairman of the Cornwall Branch in succession to **Mr. A. E. Gladwell. Mr. C. A. Wain** (engineer, East Midlands Electricity Board, Rugby) has succeeded **Mr. A. G. Wyatt** as chairman of the Rugby Branch, and

*Mr. Jules Thorn, chairman and managing director of Thorn Electrical Industries, Ltd., cutting the ribbon to mark the official opening of Thorn House, the company's new headquarters building in Upper St. Martin's Lane, London. With Mr. Thorn is Councillor D. Cobbold, Deputy Mayor of Westminster*

**Mr. A. Webb,** M.I.E.E. (Mechanical & Electrical Engineering Co. (Sheffield), Ltd.), who was the hon. secretary from 1948 to 1958 of the Sheffield Branch, has now taken up the chairmanship of that branch in succession to **Mr. W. E. Degenhardt.**

**Mr. J. E. Robson,** M.C., of Samuel Osborn & Co., Ltd., Sheffield, has been appointed to the board of the company.

**Mr. L. Teeman,** B.Sc.(Eng.), A.M.I.E.E., has been appointed sales manager of W. Lucy & Co., Ltd. Mr. Teeman, who will operate from Oxford, was educated at Leeds University and received his training as a graduate apprentice with the British Thomson-Houston Co., Ltd., Rugby. After a short period in the Plant Sales Department of that company he became a sales engineer in the London office of Crompton Parkinson, Ltd. Subsequently he was appointed switchgear and transformer sales engineer, covering the Southern Area Boards and Divisions.

*Mr. L. Teeman*

**Mr. R. J. Roy,** D.F.H., A.M.I.E.E., has been appointed sales manager of E. N. Bray, Ltd. He received his early training at Faraday House and subsequently joined Asea Electric, Ltd. During the last war he served in the electrical branch of the R.N.V.R. as a lieutenant in the Anti-Submarine Branch. After returning to Asea in 1946 in charge of outside installation of large printing press contracts he was appointed by George Ellison, Ltd., to handle sales and service in the London area.

*Mr. R. J. Roy*

**Lord Chandos,** chairman of Associated Electrical Industries, Ltd., visited the Gravesend Works of W. T. Henley's Telegraph Works Co., Ltd. (a member of the A.E.I. group), on 9th September. Accompanying him were Dr. J. N. Aldington (managing director of Siemens Edison Swan, Ltd., and a director of A.E.I. and Henley's), Sir Alexander Sim (chairman of Henley's) and Mr. E. M. Whitaker (personal assistant to Lord Chandos). They were received by Mr. S. J. Wilson (works manager) and Mr. V. B. Twiss (assistant works manager) and were shown round the various departments by Mr. H. C. Hoban (Engineering Works manager), Mr. D. Jones (cable works foreman), Mr. C. W. Christie (cable superintendent) and Mr. W. C. Barry (research manager).

*Lord Chandos, Mr. C. W. Christie, Mr. E. M. Whitaker and Mr. S. J. Wilson at Henley's Gravesend Works*

**Mr. C. F. Gimson** has been appointed divisional assistant chief engineer, A.E.I. Motor and Control Gear Division. He received his technical training at Acton Technical College and Northampton Polytechnic, London, and joined the British Thomson-Houston Co., Ltd., in 1924. After serving a drawing office apprenticeship at the company's switchgear works, Willesden, he transferred in 1929 to the Switchgear Engineering Department where he was concerned with the design of high voltage switchgear, and later with tool design. From 1937 to 1939 Mr. Gimson specialised in the design of high voltage air-blast circuit-breakers. During the last war he was engaged in aircraft engineering for the R.A.F. and the American Air Force. In 1945 he transferred to A.E.I. (India), Ltd., Calcutta, spending two years on hydro-electric schemes. Mr. Gimson returned to Willesden in 1947 and was responsible for the design of the new 275 kV lenticular tank circuit-breaker until 1948 when he was appointed deputy chief control gear engineer at the company's Rugby works. He became manager of the Control Gear Engineering Department in 1950.

As we report on page 294, **Mr. W. Percy McGeoch,** joint managing director of William McGeoch & Co., Ltd., has been appointed chairman of Veritys (Maxlume), Ltd., and Veritys (Switchgear), Ltd., the two companies which William McGeoch & Co., in conjunction with F. & C. Osler, Ltd., have purchased from the liquidator of Veritys, Ltd. The joint managing directors of the two companies are **Mr. W. T. Grant,** who was manager of the Lighting and Heating Division of Veritys, Ltd., for seventeen years, and **Mr. A. Stewart,** a director of William McGeoch & Co.

*Mr. W. P. McGeoch*

**Mr. R. G. Camp** has been appointed sales manager of Square D, Ltd., and will operate from the company's new headquarters at Cheney Manor, Swindon. He joined the company when it was originally established in Great Britain as a subsidiary of the Square D Co. of America. The appointment follows his promotion earlier this year from area manager to headquarters sales manager.

*Mr. R. G. Camp*

The annual students' social evening of the **Telegraph Construction & Maintenance Co., Ltd.** (Telcon), was held at Greenwich Town Hall on 11th September and was attended by over 150 past and present students and their friends. Mr. W. F. North (chairman of the Education Committee and secretary of the Telcon Group) presided and presented the Lawes Rabjohns prize (drawing instruments) to Mr. T. D. Humberstone, who was adjudged the best apprentice of the year. Over twenty awards were made to the students for examination successes during the year. The principal guest was Mr. N. G. Treloar, education officer, British Insulated Callender's Cables, Ltd., who addressed the students.

## OBITUARY

**Major H. Richardson.**—The death occurred at Spaxton, Somerset, on 13th September of Major Harry Richardson, O.B.E., M.C., M.I.Mech.E., M.I.E.E., T.D., J.P., who was prominent in the electricity supply

industry for many years. His principal work was with the former Metropolitan Electric Supply Co., Ltd., of which he was manager and director of its many subsidiaries. He became chairman of the London Power Co., Ltd., of which the Metropolitan Co. was one of the constituents, in 1947. He had served as chairman of the London Electricity Supply Association and as president of the Incorporated Association of Electric Power Companies, both of which came to an end with the nationalisation of the electricity supply industry. Upon nationalisation in 1948 Major Richardson was appointed a part-time member of the Southern Electricity Board, but retired from that position in 1954.

**Mr. W. J. Wood,** chief assistant for the organisation of the Metropolitan-Vickers Works School, with responsibility for recruitment and selection of craft apprentices, died on 5th September. Joining the company as an apprentice instructor in 1920, he was associated with the pioneer developments of industrial education under Sir Arthur Fleming, former director of research and education, and the late Mr. K. R. Evans.

**Mr. W. S. Dyer.** — The death occurred at Brighton on 9th September of Mr. Warren Stephens Dyer, A.M.I.E.E., A.M.I.Mech.E.; he was seventy-four.

## WILLS

**Mr. I. V. Robinson,** Wh.Sc., M.I.C.E., M.I.Mech.E., formerly head of the Steam Turbine and Allied Plant Sections of B.E.A.M.A., who died on 16th April last, left £22,815 gross (£22,550 net).

**Mr. J. F. Smith,** B.Sc., M.I.E.E., late chief commercial engineer, South Wales Electricity Board, who died on 6th April last, left £10,522 gross (£10,170 net).

**Mr. F. G. Hargreaves,** works director of Aerialite, Ltd., who died on 7th May last, left £12,288 gross (£12,214 net).

**Mr. E. Taylor,** formerly chief electrical engineer with the Sheepbridge Coal & Iron Co., Ltd., who died on 31st March last, left £10,643 gross (£10,578 net).

**Mr. F. R. Stagg,** deputy chairman of Thos. W. Ward, Ltd., who died on 14th November last, left £60,438 gross (£47,268 net).

**Sir William Larke,** a former director of the British Iron and Steel Federation, left £24,922 gross (£24,615 net).

**Mr. W. H. Steele,** M.I.E.E., of the System Operation Department, South Eastern Division, Central Electricity Generating Board, left £8,926 gross (£8,573 net).

**Dr. F. Busemann,** deputy head of the Transmission and Utilisation Department of the Electrical Research Association, left £6,965 gross (£3,880 net).

**Mr. H. Payn,** M.I.E.E., manager of the Boston District of the East Midlands Electricity Board, left £10,811 gross (£10,711 net).

**Mr. H. Howitt,** late secretary and director of the British Radio Valve Manufacturers' Association, left £5,051 gross (£3,804 net).

**Mr. H. A. Stevenson,** managing director of Alexander Controls, Ltd., left £113,807 gross (£108,156 net).

**Mr. G. Bennett,** manager of the Liverpool factories of the Automatic Telephone & Electric Co., Ltd., who died on 27th April last, left £16,238 gross (£11,251 net).

# VERITYS TAKE-OVER

William McGeoch & Co., Ltd., announce that, in conjunction with F. & C. Osler, Ltd., they have purchased from the liquidator of Veritys, Ltd. (in creditors' voluntary liquidation), the two companies formed by him to acquire the following assets of Veritys, Ltd.:—The stock, plant and machinery, fixtures and fittings and goodwill of the Maxlume Department; the stock and goodwill of the Switch and Control Gear Department; and the portion of Veritys works at Aston, Birmingham, previously housing the Maxlume and Switch and Control Gear Departments. The names of the two companies are Veritys (Maxlume), Ltd., and Veritys (Switchgear), Ltd. The property purchased from the liquidator will be owned by Veritys (Maxlume), Ltd. Mr. W. Percy McGeoch, joint managing director of William McGeoch & Co., Ltd., has been appointed chairman of both companies.

The business of both companies will be carried on from Maxlume Works, Aston, Birmingham, and it is anticipated that the removal from Stirchley, Birmingham, to Aston will be completed by the end of this month. As far as possible, in view of the present reduced output of both companies, the majority of the departmental staff and workpeople who have been in the employment of the liquidator have been offered employment by the new companies, and where this has not proved practicable, efforts have been made by William McGeoch & Co. to provide employment at their works in Coventry Road, Birmingham. Both Veritys (Maxlume), Ltd., and Veritys (Switchgear), Ltd., will execute all contracts placed by Veritys, Ltd., and in future will manufacture largely the same products and all spares as were produced by Veritys, Ltd., before this company was placed in liquidation. In addition, Veritys (Maxlume), Ltd., has undertaken to produce decorative lighting fittings previously produced by F. & C. Osler, Ltd., whose premises in Broad Street, Birmingham, are due for demolition in connection with town replanning by 1962. For the time being, lighting fittings manufactured by William McGeoch & Co. will continue to be produced at that company's works in Coventry Road, Birmingham. Sales for both Veritys (Maxlume), Ltd., and Veritys (Switchgear), Ltd., will be promoted by the sales organisation of William McGeoch & Co.

Further to a recent announcement by the Brush Electrical Engineering Co., Ltd., a member of the Hawker Siddeley Group, that it was purchasing the Rotating Machines Section of Veritys, Ltd., the Brush Co. now states that the transfer to its Loughborough works of the total production relevant to this transaction has now been completed. In future all machines manufactured in accordance with Veritys designs will be marketed as the Brush-Verity range. Continuity of design as regards interchangeability and spares is being arranged. All further orders and inquiries concerning Veritys electrical rotation machines should be forwarded to the Brush Electrical Engineering Co. at Loughborough.

# TRADE MARK APPLICATIONS

Applications have been made for the registration of the following trade marks. Objections may be entered up to 9th October:

No. B757,153 (design). Class 7. Hand-guided electrically driven tools; lathes and tools for use therewith; electric compressors (machines); electrically operated machines for rewinding bandages; and parts.—Scintilla, Ltd., Soleure, Switzerland. Address for service, c/o Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.2.

**Revo Jobber.** No. 785,476. Class 7. Portable electric machines, parts and fittings and tools for use therewith.—Revo Electric Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs.

**STC** (design). No. 781,421. Class 9. Electro-technical apparatus and component parts; and parts made of shaped magnetic ferrites for use in electrical communication apparatus and in scientific instruments.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

**Duolectric.** No. B783,268, **Unilectric.** No. B783,269. Class 9. Adding, calculating and accounting machines, all being electrically operated.—Sumlock, Ltd., 39, St. James's Street, London, S.W.1.

**Galvion.** No. 785,473. Class 9. Multiple-disc anodes for the cathodic protection of heat exchangers and of parts of heat exchangers against corrosion caused by electrochemical action.—J. Badovinac, Seattle, U.S.A. Address for service, c/o Bosshardt, Percival & Co., 94, Market Street, Manchester, 1.

**Airstream.** No. B786,338. Class 9. Electric vacuum cleaners and parts and fittings.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

**Radivue.** No. 787,287. Class 9. Electric induction communication apparatus and sound recording and sound reproducing apparatus, and parts.—Granada TV Network, Ltd., 36, Golden Square, London, W.1.

**Silistor.** No. 787,585. Class 9. Electrical resistors.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

**Pargo.** No. 788,569. Class 9. Plugs, being electrical fittings.—P.A.R., Ltd., Talbot Works, Talbot Street, Nottingham.

**Union Carbide.** No. 769,219. Class 11. Electric lamps and torches; shaped sections of refractory materials for the construction and lining of furnaces, cupolas, nuclear reactors, etc.; and carbons for electric lighting purposes, etc.—Union Carbide Corporation, New York, U.S.A. Address for service, c/o Marks & Clerk, 57/58, Lincoln's Inn Fields, London, W.C.2.

**Sellenco.** No. B782,235. Class 11. Cooking apparatus and heating apparatus, all being electric.—S. W. Ellis, trading as the Ellis Engineering Co. (Dorset), Brymers Avenue, Fortuneswell, Portland, Dorset.

# LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

## Church Heating by Infra-Red Radiation

THE article by Mr. R. J. Francis in your issue dated 11th September is a most interesting justification for the use of radiant heating in churches, but it ignores an important factor which should be the concern of heating consultants. All too often the urgent requirements of low capital and running costs lead to the conclusion that the modern electric infra-red heater can provide a satisfactory alternative to convection heating, but it must not be overlooked that the comfort of the congregation is not the only consideration.

Too many of our older churches are appealing for support of their "Roof" or "Fabric" funds, and the present common practice of one day's heating and six days' cooling must be detrimental to the life of the structure.

Mr. Francis in his final paragraph refers to churches in daily use and mentions the desirability of providing background heating. In my view this is important in every case and should provide, irrespective of outside ambient, for a temperature rise of not less than 10°F, which can be provided by thermal storage means if a suitable tariff is available. Unless this is done, I fear that the use of radiant heating alone will increase the rate of deterioration of the building and its furnishings.

The booklet on church heating published by the Church Information Board for the Central Council for the Care of Churches expresses natural concern at the effect any heating system may have on ancient fabrics and approves the use of electricity except on the score of cost. Recent changes in fuel economics have substantially improved the competitive position of electricity, and it is therefore doubly important that technically satisfactory schemes should be put forward, even where these are not the cheapest.

On a more practical note it would be helpful if the author would give advice on the maintenance of infra-red heaters to preserve their radiant efficiency. How often should reflectors be cleaned and with what materials? How seriously is the distribution affected when the reflectors become dull with age, and what is the alteration in wavelength of the peak radiated energy after, say, 1,000 hours' use?

*Aldridge, Walsall, Staffs.* S. D. DINENAGE, A.M.I.E.E.

# ELECTRICAL SYSTEM FOR JET AIRLINER

THE electrical power system in the new DH.121 jet airliner will be designed, developed and supplied by Associated Electrical Industries, Ltd., which now incorporates the interests of the British Thomson-Houston Co., Ltd. Of particular interest among the components to be produced for the three-channel 200 V, three-phase constant-frequency power system in each aircraft will be brushless alternators and static magnetic-amplifier control equipment using silicon semiconductor power rectifiers. With these components, long-life contactors and extensive use of static equipment, the overhaul period for the system will be extended to 3,000 hours, approximately double that usually necessary for other kinds of system.

*A 50 kVA, 200 V alternator similar to that which will be supplied for the DH.121 aircraft*

Three brushless alternators will not normally operate in parallel but on a three-channel system and will each be capable of giving a full output of 22·5 kVA, 400 c/s, at 200 V. Provision will be made for switching essential loads in case of alternator failure and also for parallel operation if considered desirable. A feature of the new alternator will be the circulation of oil through the bearings from the hydraulic constant-speed unit which will drive the alternator at 8,000 r.p.m. With a brushless machine, the limiting factor for overhaul life is the bearings.

In each power circuit protection against over- and under-voltage, over- and under-frequency, fault current, out-of-balance current and incorrect phase rotation will be included, all of which will be applied by static equipment operating the main power contactor. When parallel operation is desired, automatic synchronising circuits will be applied.

In the DH.121 aircraft, over 200 toggle-type switches of single-, double- and triple-pole types with ratings up to 15 A at 200 V will be used. More than 200 thermal-trip circuit-breakers will be employed, the ratings varying from 1 A to 24 A, on single-phase and three-phase circuits. All three-phase circuit-breakers will have protection against single-phase faults. About thirty power contactors with ratings ranging from 15 A up to 100 A at 200 V, some magnetically-held, others mechanically-latched, will be used.

Motors will vary in size from the very small 4½ oz types to be used for the cooling fans in radar and radio equipment to the larger continuously-rated motors for driving aircraft equipment, cabin air recirculation fans, etc. The largest of these motors will be of 8 h.p. rating for driving hydraulic pumps for ground service and emergency undercarriage retraction.

## *Financial Section*

# STOCKS and SHARES

FOR the moment, only one consideration seems to matter very much in the Stock Exchange, and until it is settled one way or the other on 8th October, the markets will not be expected to establish any decided trend. The volume of business has contracted quite markedly. Most institutional and private investors have evidently made up their minds to stand fast, and any large movement in share prices is usually the result either of individual company news or of speculative dealings based on political views. In the latter connection the market in steel shares is the obvious field for action, and despite a good deal of fluctuation its behaviour has indicated some degree of confidence that the re-nationalisation threat to the industry will not materialise. New issues have continued to provide special points of interest among electrical shares.

### New Issues

A sizeable volume of business has been passing in the new shares issued by Plessey and Thorn Electrical Industries to their shareholders. The usual selling of the "rights" by members deciding for one reason or another not to subscribe for their allotments has been countered by a good demand from those who welcome these occasions as an opportunity to acquire shares free of the expense of the 2 per cent transfer stamp duty, and at prices which may be temporarily below normal. Selling of "rights" to a cash issue is usually at its heaviest in the period before the first instalment falls due to be paid, after which (other things being equal) a hardening of the price is a by no means uncommon occurrence.

### Plessey and Thorn

On Plessey's issue of 3·6 million new 10s ordinary shares, the first instalment of 10s is due by next Tuesday, 22nd September, and the balance of 13s 6d in December. They have been changing hands at a premium of 10s, making an all-in cost of 33s 6d (free of transfer stamp). Assuming an annual dividend rate of 14 per cent on the increased capital, with more than twofold earnings cover on the basis of the company's latest profits estimate, the yield is 4·2 per cent. The new shares will not rank for this year's final dividend. Payment for Thorn Electrical Industries new 5s ordinary shares, offered at 25s, is due in full by 25th September. With the shares quoted at a premium of 8s 9d, and the directors' forecast of a 20 per cent dividend on the larger capital, the yield works out at less than 3 per cent. This relatively modest return would be related to the substantial margin which the company has always maintained between earnings and distributions, and also no doubt to the confident tenor of the directors' recent review of prospects for the group's radio, lighting and other activities.

### Price Changes

For the most part the industrial share lists show mixed changes, few

## *Price Changes in*

| Company or Board | Nom. Value | Middle price 14th Sept. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % | 1959 Highest | 1959 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Gilt-edged Stocks* | | | | | | £ s d | | |
| Brit. Elec. 1968/73 ... ... | 100 | 78 | | 3 | 3 | 3 17 0 | 80½ | 77½ |
| Brit. Elec. 1974/77 ... ... | 100 | 75 | | 3 | 3 | 4 0 0 | 77 | 74½ |
| Brit. Elec. 1976/79 ... ... | 100 | 79½ | | 3½ | 3½ | 4 8 0 | 80½ | 77½ |
| Brit. Elec. 1974/79 ... ... | 100 | 88 | | 4½ | 4½ | 4 15 9 | 91 | 87½ |
| *Overseas Electric Supply* | | | | | | | | |
| Calcutta Elec. ... ... ... | £1 | 19/- | | 6·8† | 7† | 11 18 0 | 19/6 | 16/- |
| East African Power ... ... | £1 | 20/6 | | 7½ | 8 | 7 16 0 | 22/3 | 19/3 |
| Nigerian Elec. ... ... ... | £1 | 14/6 | | 8 | 8 | 11 0 6 | 15/- | 13/- |
| Perak Hydro-Elec. ... ... | £1 | 15/- | | 12½ | 10 | 13 6 9 | 15/- | 12/3 |
| *Electrical Shares* | | | | | | | | |
| Aberdare Holdings ... ... | 5/- | 16/6 | | 17½ | 17½ | 5 6 0 | 16/9 | 15/6 |
| Aerialite ... ... ... | 1/- | 9/3 | +3d | 51½ | 54 | 5 16 9 | 9/6 | 7/9 |
| Allen, W. H. ... ... ... | £1 | 51/3 | | 11 | 12 | 4 13 9 | 51/3 | 43/- |
| Allied Insulators ... ... ... | 5/- | 19/6 | −1/9 | — | 20‡ | 5 2 6 | 21/6 | 18/9 |
| Anglo-Portuguese Tel. ... ... | £1 | 29/- | | 9 | 9 | 6 4 3 | 29/6 | 26/6 |
| Aron Elec. Ord. ... ... ... | £1 | 56/3 | | 15 | 15 | 5 6 9 | 62/6 | 55/- |
| Assoc. Elec. Ord. ... ... | £1 | 60/- | +6d | 15 | 15 | 5 0 0 | 63/6 | 53/9 |
| Automatic Tel. & El. ... ... | £1 | 75/- | | 17 | 17‡ | 4 10 9 | 82/6 | 71/3 |
| Babcock & Wilcox ... ... | £1 | 49/- | | 13‡ | 13 | 5 6 0 | 54/6 | 45/6 |
| Bakelite ... ... ... ... | 10/- | 30/- | −1/3 | 15 | 15 | 5 0 0 | 31/3 | 22/- |
| Baldwin, H. J. ... ... ... | 2/- | 2/6 | | 20 | 20 | — | 3/- | 2/3 |
| Berry's Electric ... ... ... | 5/- | 21/3 | | 10 | 20‡ | 4 14 0 | 22/- | 7/3 |
| Bowthorpe Holdings ... ... | 2/- | 15/- | +3d | 25 | 27 | 3 12 0 | 15/6 | 11/9 |
| British Elec. Traction: | | | | | | | | |
| Def. Ord. "A" ... ... | 5/- | 37/6 | | 25 | 35 | 4 13 3 | 41/- | 35/6 |
| B.I. Callender's ... ... ... | £1 | 52/- | −6d | 12½ | 13½ | 5 3 9 | 56/6 | 44/9 |
| B.I. Callender's 6% Pref. ... | £1 | 20/6 | | 6 | 6 | 5 17 0 | 20/6 | 19/9 |
| British Thermostat ... ... | 5/- | 28/- | | 30 | 35 | 3 2 6* | 28/- | 18/6 |
| British Vac. Cleaner ... ... | 5/- | 7/9 | | 10 | 7½* | 4 16 9 | 7/9 | 4/6 |
| Brook Motors ... ... ... | 10/- | 51/3 | +6d | 25 | 24‡* | 4 14 0 | 54/3 | 46/- |
| Bulgin, A. F. ... ... ... | 1/- | 10/6 | | 45 | 50 | 4 15 3 | 10/6 | 6/9 |
| Bulpitts ... ... ... ... | 5/- | 17/3 | −1/- | — | 15 | 4 7 0 | 18/3 | 10/- |
| Burco Dean ... ... ... | 5/- | 16/- | +6d | 22½ | 16* | 5 0 0 | 16/- | 12/3 |
| Cable & Wireless: | | | | | | | | |
| Ord. ... ... ... ... | 5/- | 15/9 | | 10 | 10* | 3 3 6 | 16/- | 12/3 |
| 4% Loan ... ... ... | 100 | 94½ | | 4 | 4 | 4 4 9 | 95 | 93 |
| Chloride El. Storage "A" ... | £1 | 57/6 | +6d | 17½ | 20‡ | 4 12 6* | 60/- | 43/8 |
| Clarke Chapman ... ... ... | £1 | 53/9 | | 27½ | 13‡* | 5 2 3 | 66/3 | 52/6 |
| Cole, E. K.... ... ... ... | 5/- | 20/3x.r. | | 17½ | 20 | 4 18 9 | 23/6 | 17/3 |
| Contactor Switchgear ... ... | 5/- | 15/- | | 20 | 14* | 4 13 3 | 15/- | 12/- |
| Cossor, A. C. ... ... ... | 5/- | 8/- | +3d | Nil | 5 | 3 2 6 | 9/- | 6/3 |
| Crabtree ... ... ... ... | 10/- | 30/3 | | 20 | 20 | 6 12 3 | 31/6 | 28/- |
| Crompton Parkinson ... ... | 5/- | 14/- | | 16 | 12* | 4 5 9 | 14/3 | 11/9 |
| Davis & Timmins ... ... ... | 5/- | 17/- | | 18 | 20 | 5 17 9 | 17/- | 14/6 |
| De La Rue ... ... ... | 10/- | 50/- | −1/- | 17½ | 20 | 4 0 0 | 54/- | 30/3 |
| Decca "A" ... ... ... | 10/- | 38/- | +1/- | 43‡ | 50 | 5 5 3* | 40/3 | 33/3 |
| Desoutter ... ... ... ... | 5/- | 27/6 | | 32½ | 21‡* | 3 18 9 | 27/6 | 19/- |
| Dewhurst ... ... ... ... | 2/- | 8/- | | 20 | 20 | 5 0 0 | 8/3 | 7/3 |
| Dictograph Tel. ... ... ... | 2/- | 8/- | +6d | 20 | 20 | 5 0 0 | 8/3 | 7/- |
| Dubilier Condenser ... ... | 1/- | 4/6 | | 20 | 25 | 5 11 0 | 5/- | 3/3 |
| Duport ... ... ... ... | 5/- | 14/3 | | 25 | 12½* | 4 7 9 | 14/3 | 10/3 |
| E.M.I. ... ... ... ... | 10/- | 52/6 | +1/3 | 15 | 20*‡ | 3 16 3 | 64/6 | 48/- |
| Electrical Apparatus ... ... | 5/- | 15/- | | 12½ | 14½ | 4 16 9 | 15/- | 13/- |
| Electrical Components ... ... | 5/- | 14/9 | +3d | 12½ | 15 | 5 1 9 | 15/9 | 10/6 |
| Elec. Construction ... ... | £1 | 33/6 | | 8½ | 9 | 5 7 6 | 33/6 | 27/9 |
| Elliott-Automation ... ... | 5/- | 22/6 | −1/3 | — | 10‡ | 2 4 6 | 30/6 | 16/9 |
| English Electric ... ... ... | £1 | 43/- | | 14 | 14 | 4 6 9* | 45/- | 37/10 |
| English Electric 3½% Pref. ... | £1 | 13/- | | 3½ | 3½ | 5 15 6 | 12/9 | 12/3 |
| Ericsson Tel. ... ... ... | 5/- | 22/9 | | 12† | 13† | 4 7 6 | 27/3 | 22/3 |
| Ever Ready ... ... ... | 5/- | 25/- | +9d | 20 | 27½‡ | 3 6 0* | 26/- | 13/3 |
| Falk Stadelmann ... ... ... | £1 | 25/- | | 17½ | 10*‡ | 8 0 0 | 32/9 | 25/- |

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

of them of any great consequence. G.E.C. ordinary shares have been notably well supported up to the neighbourhood of 40s, while the premium on the company's newly issued 6 per cent loan stock improved to over 2 points. A.E.I. and English Electric were firm, and Reyrolle were 1s 3d better at 91s 3d in sympathy with the improvement in C. A. Parsons after the latter's interim dividend declaration. Reyrolle's interim payment for the current year was unchanged. Some domestic equipment and radio issues such as Hoover and Morphy-Richards were a little higher on the strength of the latest official figures showing an increase of 33 per cent in sales (mostly on hire-purchase) by radio and electrical shops in July, as compared with the same month of last year. James Scott (Electrical Engineers) 5s shares were quoted at 29s following the announcement of a coming scrip issue of preference and ordinary shares.

## *Electrical Investments*

| Company or Board | Nom. Value | Middle price 14th Sept. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % £ s d | 1959 Highest | 1959 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Electrical Shares—continued* | | | | | | | | |
| G.E.C. | £1 | 39/6 | +1/6 | 10 | 10 | 5 1 3 | 40/3 | 31/3 |
| G.E.C. 6½% Pref. | £1 | 22/- | | 6½ | 6½ | 5 18 3 | 22/- | 20/3 |
| General Cables | 5/- | 8/3 | | 24 | 15 | 9 2 0 | 9/3 | 7/6 |
| Greenwood & Batley | £1 | 105/- | | 20 | 30 | 5 14 3 | 105/- | 75/- |
| Hackbridge Holdings | 5/- | 17/3 | +6d | 20 | 20 | 5 16 0 | 19/3 | 14/3 |
| Hackbridge & Hewittic | 5/- | 13/6 | | 20 | 20 | 5 11 0* | 13/6 | 10/6 |
| Head Wrightson | 5/- | 32/- | +2/- | 17½ | 20* | 3 2 6 | 32/- | 24/3 |
| Heatrae | 2/- | 9/- | +1/- | 20 | 20 | 4 9 0 | 10/- | 7/6 |
| Holophane | 5/- | 17/6 | | 37½ | 22½* | 6 8 6 | 18/9 | 14/9 |
| Hoover | 5/- | 78/9 | +1/3 | 50 | 60 | 3 16 3 | 81/6 | 55/- |
| I.C.I. | £1 | 41/- | +1/- | 12 | 8* | 3 18 0 | 42/6 | 33/- |
| Intl. Combustion | 5/- | 35/- | | 25 | 30‡ | 4 5 9 | 36/6 | 29/9 |
| Intl. Computers & T. | £1 | 65/- | +6d | — | 8‡ | 2 9 3 | 78/9 | 57/6 |
| Johnson & Phillips | £1 | 21/- | −6d | 5 | 5 | 4 15 3 | 30/6 | 21/- |
| Lancashire Dynamo | £1 | 43/- | −9d | 11 | 12½‡ | 4 7 0* | 43/9 | 31/6 |
| Laurence Scott | 5/- | 17/3 | | 15 | 15 | 3 15 0* | 17/3 | 14/- |
| Lister, R. A. | £1 | 42/- | | 10 | 12½ | 5 19 0 | 42/- | 32/9 |
| Lucas, J. | £1 | 53/- | | 7½ | 10‡ | 3 15 6 | 55/- | 43/3 |
| Marconi Marine | £1 | 42/- | | 10 | 10 | 4 15 3 | 48/6 | 40/- |
| Marryat & Scott | 2/- | 9/9 | | 37½ | 22½* | 4 12 3 | 10/- | 8/6 |
| Mather & Platt | £1 | 45/6 | | 15 | 10‡* | 4 14 0 | 51/6 | 41/3 |
| Metal Industries | £1 | 52/6 | +9d | 14 | 14 | 5 6 9 | 56/3 | 39/9 |
| Midland Elec. Mfg. | £1 | 46/3 | | 12½ | 10* | 4 6 6 | 46/3 | 41/6 |
| Morphy-Richards | 4/- | 28/9 | +3d | 20 | 20 | 2 15 9 | 30/6 | 18/- |
| Murex | £1 | 51/3 | | 17½ | 15 | 5 17 0 | 51/3 | 42/- |
| Newman Ind. | 2/- | 3/3 | | 10 | 10 | 6 3 0 | 3/6 | 2/3 |
| Oldham & Son | 1/- | 3/- | | 17½ | 17½ | 5 16 9 | 3/- | 2/6 |
| Parsons, C. A. | £1 | 50/- | +2/6 | 7½ | 8½‡ | 3 5 0 | 55/9 | 45/9 |
| Philips' Lamps | Fl.10 | 124/- | | 14 | 14 | 2 2 9 | 130/- | 88/- |
| Plessey | 10/- | 33/6 | +1/- | 30 | 14*‡ | 4 3 6 | 37/6 | 23/6 |
| Pye | 5/- | 15/- | | 12½ | 12½ | 4 2 3 | 16/9 | 13/9 |
| Pyrotenax | 5/- | 40/- | | — | 34 | 4 5 0 | 40/- | 33/9 |
| Reliance Clifton | 5/- | 24/- | +6d | 15 | 15 | 3 2 6 | 23/6 | 17/6 |
| Reyrolle | £1 | 91/3 | +1/3 | 17½ | 17½ | 3 16 9 | 98/- | 85/9 |
| Rheostatic | 4/- | 10/3 | −3d | 12½ | 12½ | 4 17 6 | 10/9 | 8/3 |
| Richardsons Westgarth | 10/- | 12/3 | | 8½ | 8½ | 6 16 0 | 15/3 | 12/- |
| Simon-Carves | 5/- | 29/6 | | 25 | 25 | 4 4 9 | 32/- | 28/6 |
| Smith (England), S. | 4/- | 16/9 | +6d | 20 | 12½*‡ | 2 19 9 | 17/6 | 11/6 |
| Southern Areas | £1 | 14/- | −6d | Nil | Nil | Nil | 15/- | 10/6 |
| Strand Elec. | 5/- | 11/9 | | 15 | 20 | 8 10 3 | 11/9 | 8/6 |
| Sturtevant | 5/- | 18/- | | 15† | 15† | 6 16 0 | 20/- | 17/- |
| Sun Elec. | 5/- | 16/9 | | 25 | 25 | 3 14 9* | 16/9 | 8/3 |
| Switchgear & Cowans | 5/- | 13/9 | | 22½ | 15* | 5 9 0 | 13/9 | 10/3 |
| T.C.C. | 10/- | 46/3 | −9d | 25 | 25 | 5 8 0 | 47/- | 38/- |
| Telephone Mfg. | 5/- | 6/3 | | 10 | 10 | 8 0 0 | 6/3 | 4/9 |
| Telephone Rentals | 5/- | 16/9 | −3d | 12½ | 12½* | 3 14 9 | 17/- | 11/9 |
| Thompson (John) | 5/- | 20/6 | +6d | 25 | 25 | 6 2 0 | 25/6 | 20/- |
| Thorn Elec. | 5/- | 35/- | +6d | 17½ | 20 | 2 17 3 | 40/- | 26/3 |
| Thornycroft | £1 | 27/- | +9d | 12½ | 7½ | 5 11 0 | 30/- | 20/6 |
| Tube Investments | £1 | 88/9 | −9d | 15 | 17½ | 3 19 0 | 91/6 | 71/6 |
| Vactric | 5/- | 43/9 | −9d | 25 | 37½ | 4 5 9 | 46/6 | 26/3 |
| Veritys | 5/- | 1/6 | | 12½ | 2½ | — | 5/- | 1/3 |
| Walsall Conduits | 4/- | 12/6 | | 22½ | 22½ | 4 2 0* | 14/2 | 10/8 |
| Ward & Goldstone | 5/- | 46/- | +1/- | 25 | 30 | 3 5 3 | 46/3 | 30/6 |
| Watford | 2/- | 10/- | +6d | 25 | 25* | 5 0 0 | 10/- | 7/6 |
| Westinghouse | £1 | 48/3 | +9d | 10 | 10 | 4 3 0 | 48/3 | 39/6 |
| West, Allen | 5/- | 12/9 | | 12½ | 11½* | 4 11 0 | 14/- | 11/9 |
| Wolf Electric | 5/- | 9/- | −3d | 10 | 10 | 5 11 0 | 9/3 | 7/9 |

### Cossor Recovery

A. C. Cossor's announcement of a profit of £223,000 for the year ended in March, and of a 5 per cent dividend, fulfils the forecast of better results made by the chairman a year ago, when the accounts for 1957–58 showed a loss of £14,000 and there was no distribution on the ordinary capital. Since then the company has sold the radio and television subsidiary, whose losses were said to have been submerging the satisfactory earnings of other members of the group. Provisions amounting to £365,000 have been made from capital reserves for possible deficits resulting from its disposal. The ordinary dividend absorbs less than one-third of the net surplus of £133,000 (after tax) and gives a yield of a fraction under 3½ per cent on the 5s shares at a price of 8s.

### Company News

The declaration by C. A. Parsons of an increase in the interim dividend for the current year to 4½ per cent, in comparison with last year's corresponding payment of 3½ per cent, agreeably surprised the market, where the price of the £1 shares was marked up from 47s 6d to 50s. The last total distribution was 8½ per cent, including ½ per cent in the form of a special interim. Dealings began this week in an issue of 1·6 million new ordinary shares by E. K. Cole. Early transactions were at a premium of 4s 3d on the price of 16s at which they are offered to existing shareholders on a one-for-three basis. The old shares were quoted "ex-rights" at 20s 3d, to yield nearly 5 per cent at the present rate of dividend.

### Pifco's Progress

The 4s shares of Pifco Holdings were raised to 24s 6d after the news of higher profits for 1958–59 and an increase in the dividend from 20 to 25 per cent. The net surplus of £109,000, after tax, is a little above the previous figure and appears from the preliminary statement to cover as much as seven times over the amount of the distribution: when the operating business of Pifco was acquired in 1957 a proportion of the cash consideration was left for payment at the discretion of the directors, who have previously declared the intention of pursuing conservative dividend policies while this remains outstanding and while the husbanding of resources is desirable in financing a growing business.

# REPORTS and DIVIDENDS

**Aron Electricity Meter, Ltd.**—The annual meeting will be held on 30th September. In his statement circulated to stockholders, Sir Edward Herbert (chairman) says that it seems probable that, for some years ahead, the demand on their industry will continue at about the current level. During the year under review they maintained their share of the available business in the home market, despite intensive competition. Although there has been an increase in export business, this is less remunerative than in the home market, because prices overseas are depressed by foreign competition. Business in other than meters was of reasonable volume, but was very much less than has been the case in the past. The value of orders in hand to date is, however, more satisfactory than for some time past, although profit margins are smaller. They are not reaping the full benefit from the recent expansion of their Technical Department. He had felt justified in hoping that some of the new projects would by now have reached the stage at which they could commence to market them, but they have encountered difficulties with the result that they have not yet been able to develop these new projects to the extent that they expected.

**James Scott & Co. (Electrical Engineers), Ltd.**, is calling a meeting for 30th September for the purpose of increasing the authorised capital by the creation of 450,000 6½ per cent second cumulative preference shares of £1 each and an additional 800,000 ordinary shares of 5s each. It is also proposed to capitalise £196,662 of reserves. It is intended to issue, credited as fully paid, 171,000 6½ per cent second cumulative preference shares and 102,608 ordinary shares to ordinary shareholders in the proportion of one new preference share for every six ordinary shares held and one new ordinary share for every ten ordinary shares held. Application is to be made to the Stock Exchange, London, and the Glasgow Stock Exchange for permission to deal and for quotation for both the new preference and ordinary shares. The new ordinary shares will rank *pari passu* in all respects with the existing ordinary shares including the right to any dividend which may hereafter be declared.

**A. C. Cossor, Ltd.**, reports that, after the elimination of Cossor Radio & Television, which was sold and thus ceased to be a subsidiary during the year, the trading profit for the year to 31st March last was £223,345, as compared with a loss of £14,516 for the preceding year. Taxation requires £83,934 and, after allowing for the profits of a subsidiary attributable to outside shareholders, there is attributable to the members of A. C. Cossor a profit of £132,751 (against a loss of £44,112), of which £101,545 is the parent company's net profit (against a loss of £52,594). It is proposed to pay a dividend for the year of 5 per cent (against nil), and to carry forward a group balance of £142,182 (against £128,549 brought in).

**E. K. Cole, Ltd.**—Underwriting has been completed by the London and Yorkshire Trust for an issue of 1·3 million 5s ordinary shares at 16s per share, of which 1,117,583 will be provisionally allotted in the proportion of one for every three 5s units held. Ordinary stockholders may apply for excess shares. Preference and preferred ordinary stockholders may apply for any shares left after that.

**Pifco Holdings, Ltd.**—Profits for the year ended 30th April last amounted to £218,811, as compared with £197,779 for the previous year. Taxation absorbed £109,494. The proposed final dividend is 17½ per cent (against 12½ per cent), making 25 per cent (20 per cent) for the year.

**Bowthorpe Holdings, Ltd.**, are paying an interim dividend of 10 per cent (against 7 per cent). It is stated that the increase is made to reduce the disparity between the interim and final dividends.

**Radio Rentals, Ltd.**—Underwriting has been completed for an issue of 1,600,000 5s ordinary shares at 20s each. The new shares will be provisionally allotted to ordinary shareholders in the proportion of one for every six held.

**C. A. Parsons & Co., Ltd.**, are paying an interim dividend of 4⅛ per cent (against 3¼ per cent).

**The Watford Electric & Manufacturing Co., Ltd.**, has announced an interim dividend of 5 per cent (unchanged).

**A. Reyrolle & Co., Ltd.**, are paying an interim dividend of 6½ per cent (unchanged).

**Relay Exchanges, Ltd.**, has declared an interim dividend of 8 per cent (against 7½ per cent) on increased capital.

## New Companies

**Mayfield Electrical Appliances, Ltd.**—Registered 29th July. Capital £100. Manufacturers and designers of and wholesale and retail dealers in all kinds of domestic appliances, including washing machines, spin dryers, dish washing machines, radio apparatus, etc. Directors: H. B. Vine and H. B. Kirby. Regd. office: 40, Mayfield, Wembley Park, Mdx.

**Midland Electrical Maintenance Co. (Leicester), Ltd.**—Registered 4th August. Capital £1,000. Directors: J. Dilks and D. Eadie. Regd. office: 107, Princess Road, Leicester.

**Dikes (Sherborne and Yeovil), Ltd.**—Registered 6th August. Capital £1,000. Electrical engineers, etc. D. L. Dike signs as director. Solicitors: A. E. Nichols, Strickland & Fletcher, Bristol, 1.

**Instruments Electrical Co., Ltd.**—Registered 27th July. Capital £100. To acquire the business of electrical instrument manufacturers carried on by J. A. S. Rowe and W. G. Mitrega as Instruments Electrical Co., at 107, Newington Causeway, S.E.1, etc. Directors: J. A. S. Rowe and W. G. Mitrega. Regd. office: 107, Newington Causeway, S.E.1.

**A. R. Creaser, Ltd.**—Registered 25th June. Capital £5,000. Electrical engineers, general, electrical and refrigeration installation contractors, manufacturers and repairers of and dealers in radio and television sets, etc. Directors: A. R. Creaser and Mrs. Mary A. Creaser. Regd. office: Welburn, Yorks.

**Volta (Domestic Appliances), Ltd.**—Registered 16th June. Capital £100. Electricians, etc. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

**B.H.K. Electrical Contractors, Ltd.**—Registered 12th June. Capital £300. Electrical, mechanical, radio, automobile and general engineers, etc. Directors: R. A. B. Brighton, L. G. Harding and A. J. Kempson. Regd. office: 1, Bellevue Road, N.11.

**Jon Electrics, Ltd.**—Registered 3rd July. Capital £1,000. Electricians, electrical and electronic engineers and contractors, etc. Directors: W. A. Nisbet and Mrs. Jill M. A. Nisbet. Regd. office: 29-30, Bedford Row, W.C.1.

**Philip M. Davies, Ltd.**—Registered 1st July. Capital £5,000. Electrical engineers and contractors, manufacturers, importers and exporters of and dealers in radio apparatus, etc. Directors: P. M. Davies and Anne D. Davies. Regd. office: Post Office Yard, Swadford Street, Skipton, Yorks.

**Fleetwood Haworth & Co., Ltd.**—Registered 26th June. Capital £1,000. Electrical engineers and general electrical installation contractors, radio and television engineers and service agents, etc. Directors: J. Fleetwood and H. Haworth. Regd. office: 91, Holmfield Road, Blackpool.

**Robertsons (Domestic Appliances), Ltd.**—Registered 25th June. Capital £1,000. Manufacturers of and dealers in washing machines, spin dryers, etc. Directors: Violet E. V. Robertson, J. R. O'Donovan and T. J. O'Rourke. Regd. office: 55a, The Broadway, S.W.19.

**Pringle & Kitchen, Ltd.**—Registered 9th July. Capital £2,000. Manufacturers of and dealers in electrical fuses, valves, time switches, control gear, etc. Directors: J. Kitchen and R. D. Pringle. Regd. office: Northfield Works, Park Lane, Waltham Cross, Herts.

**Arjay Domestic Supplies, Ltd.**—Registered 10th July. Capital £100. Designers, manufacturers of and dealers in electrical appliances, etc. Directors: A. R. Ward, E. J. S. Ward and C. A. F. Fuller-Shapcott. Regd. office: White Hart House, Market Place, Newbury.

**Excel Electrical Appliances, Ltd.**—Registered 24th July. Capital £1,000. Electrical, mechanical, radio and general engineers, etc. Directors: F. W. G. Thompson and Olive I. R. Harlow. Regd. office: 118, Grenfell Road, Maidenhead.

**Ideal Electrics (Middlesbrough), Ltd.**—Registered 16th July. Capital £100. Manufacturers of and dealers in electrical appliances, etc. Directors: J. Eaton, A. J. Thomas and G. Sanderson. Regd. office: 32, Albert Road, Middlesbrough.

**Peerless Mica, Ltd.**—Registered 28th July. Capital £100. Manufacturers of and dealers in all kinds of electrical insulating materials, etc. Directors: J. N. Bullivant and P. C. Eason. Regd. office: Abbey Barn Road, Wycombe Marsh, High Wycombe.

## Bankruptcies

**E. Bowes**, 3, Front Street, Langley Park, Durham, radio and electrical engineer.—Last day for receiving proofs for dividend 22nd September. Trustee, Mr. F. P. Hunnam, 30-32, Grey Street, Newcastle-upon-Tyne, 1.

**F. Monk**, Ashby Road, Stapleton, Leics., electrical and radio engineer.—Trustee, Mr. W. W. Jordan, 27, Regent Street, Park Row, Nottingham, Official Receiver, released 3rd September.

# Improved Lighting at Norwich

## CIVIC TRUST'S DEMONSTRATION SCHEME

By D. CLARK, Dip.M.I.E.S.*

**Magdalen Street, Norwich, was selected by the Civic Trust as the subject for a demonstration street improvement scheme which included re-lighting and this article describes that part of the scheme**

THE objects of the Civic Trust (of the Board of which Mr. Duncan Sandys is president and Sir George Nelson, Bt., one of the members) are, broadly, to promote high standards of architecture and street planning in Great Britain and to encourage wider interest in the general appearance of cities, towns and villages.

In pursuance of its objects the Trust decided to promote a demonstration improvement scheme in Magdalen Street, Norwich, from Colegate to Stump Cross, and engaged Mr. Misha Black, O.B.E., architect and industrial designer, as consultant and co-ordinator of the project. The main intention of the demonstration was to tidy up the street by removing unpleasant advertisements, adjusting facias and judiciously redecorating premises in colour. The replacement of the lighting installation was included in the work. All design and consultant fees were borne by the Civic Trust.

The old lighting installation consisted of seven 400 W h.p.m.v. lamps vertically mounted in bowl refractor lanterns and spaced at an average of 190ft. The services and cable work were very untidy, much of it being overhead. The removal of the lamp columns had to be carried out early on a Sunday morning to avoid the normally heavy traffic. They were cut off by welding plant 1ft below the footpath surface. By that time the new lighting had been installed so that continuity was maintained.

Wall brackets have taken the place of columns in the new installation. Before positions were fixed for the brackets the architect and the Electrical and Lighting Engineer met and with "give and take" on both sides clarity of design and good lighting performance were achieved in a preliminary way. The site was then visited and positions were again slightly varied to achieve a common mounting height for the brackets whilst still maintaining uniformity and harmony with the various buildings. The final positions had then to be agreed with the property owners and discussed with other architects who were directly responsible for such properties as public houses and the like.

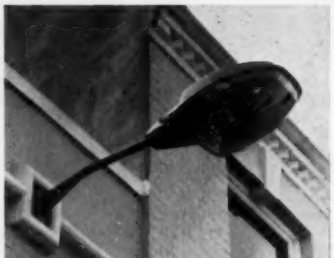
When the final positions had been agreed with all parties concerned, the next move was to find where to conceal the Electricity Board's underground services and "Rythmatic" relay control boxes, and the Council's protective fusing, choke and capacitor, contained in a composite box. When the property owners were convinced of the undesirability of leaving the equipment exposed to view, they readily agreed to the suggested situations for concealment. They also allowed several of the circuit cables to be installed "back outlet" from the lantern bracket and concealed inside the structures, the cables eventually coming through the ceilings of passages and alleyways where the control gear and/or service were placed.

The bank building at the road fork occupies a prominent position and in front of it there was a clutter of street lighting and signs. The Lighting Engineer suggested special treatment for the building, doing away with lamp columns and providing a pleasing background lighting installation.

Architectural alterations to the building had unfortunately been decided upon before the street lighting was sanctioned. Nevertheless, the matter of "built-in" lighting was quickly discussed with the architect and after

* Chief Electrical and Lighting Engineer, Norwich Corporation.

*The bank building in Magdalen Street, Norwich, before and after treatment*



*Above: Close-up of bracket fitting*

*Left: One of the new bracket fittings; the control gear is concealed behind the grille at pavement level*

a " mock-up " trial installation the following layout was decided upon for the front elevation. The five windows had been fitted with internal plastic slat sun blinds fixed at a very slight angle from the horizontal, and a fluorescent lamp was fitted at each sill, the upward light giving an interesting light pattern with the slats. A pelmet was " tailored " at high level, concealing fluorescent reflector type lamps for direct downward distribution. The apex decorative section at the highest point on the building was catered for by means of a fluorescent lamp giving upward light distribution, and the lamp was screened from direct line of sight. To complete the picture, the columns and decorative scroll work at the entrance were picked out by means of two 150 W pressed glass internal reflector floodlighting lamps. To provide a contrast the internal lamps were " natural " and the external ones " warm white." The two lower windows were fitted with a white opal " Perspex " screen at sill level, being 9in high with engraved and filled lettering.

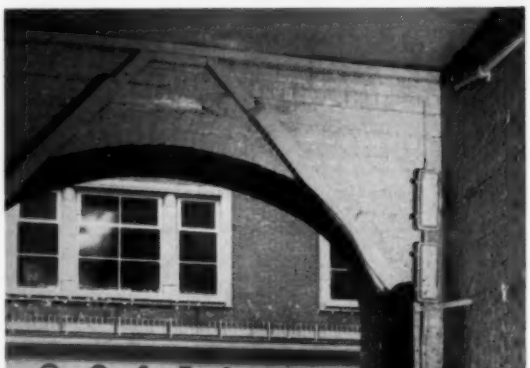
The wiring was completely concealed in the building structure and consisted mainly of mineral insulated cable. The appearance at night is quite pleasant and well worth the cost, which was no more than that of fitting a conventional lamp column with a fluorescent lantern.

One part of the road was not suitable for lighting by means of a wall bracket lantern, because the area behind the footpath was a grassed forecourt to a delightful old church. The problem was overcome, with a most pleasing effect, by floodlighting the church with two 140 W sodium vapour lanterns on the splayed side elevations. The front elevation was illuminated by two 250 W fluorescent internal reflector lamps in protective metal fittings with spill rings. All fittings were screened from view by means of evergreen shrubs.

In front of the church a new bus shelter was erected and fitted with six 2×6 W fluorescent bulkhead lighting fittings of a pleasing design with 040 white opal " Perspex " diffusers. The wiring for both installations consisted of p.v.c. and armoured cable, concealed under the turf. The p.v.c. cable for the bus shelter lighting was completely hidden within the structure.

There were two possible arrangements for an underground service and relay box—a separate cupboard situated behind a public telephone kiosk, or a loop service connection from inside the kiosk. After much discussion with telephone officials, the manager agreed to allow the kiosk to be used for the street lighting relay control. A relay box was therefore fitted in the kiosk and connected to a separate fuseway in the Electricity Board's intake service unit. An underground box was fitted to connect the bus shelter and the floodlighting of the church. A p.v.c. armoured cable connected to the box was taken to the relay control box inside the telephone kiosk. Local fusing was provided to ensure reasonable protection and isolation of faults.

The Atlas " Alpha Three " lantern for 250 W or 400 W fluorescent lamps consists of a hermetically sealed lamp enclosure and light control system, and an end support. The latter embodies a fixed lampholder and sealing cap, and a support rod for the lamp enclosure, which is a one-piece assembly of a deep-drawn reflector and an acrylic plastic cover. The reflector is pressed in Noral D57S sheet and electrolytically brightened and anodised (Vulcan Stove Co., Ltd., Exeter). For this installation the exterior was given a gun-metal colour finish (B.S. 2660, ref. Grey 9-097). The bowl is of ⅛in thick " Perspex," slightly pink tinted, shaped by Arrow Plastics, Ltd.




*Another method of keeping the control gear out of sight*

The lantern has good cut-off characteristics so essential for a mercury lantern for reasonable comfort conditions. It is designed for a medium-angle beam distribution, which is an advantage for spacing conditions over the conventional cut-off lantern. Light control is by means of a specially designed reflector with side panel segments of a large paraboloid supplemented by facets in the top section. The light output per 100 linear feet of roadway, at 100ft spacing, is 7,030 lumens.

Mounting height of the lanterns is 23ft from footpath level, the spacing in general not exceeding 75ft. The reason for this spacing was the choice of the 250 W fluorescent lamp rather than the 400 W lamp. It was felt that a more comfortable installation would result with a very even distribution throughout. This was found to be so, and strongly confirmed by night motorists. The modifications to the standard lantern were carried out at the request of Mr. Misha Black.

The wall bracket was specially designed for this installation by the Lighting Engineer and approved by the consulting architect. It was manufactured at one of the City Engineer's workshops. The main points in the design were the avoidance of a "stuck-on" look, and rear entry for cables to ensure concealment wherever possible. The brackets were painted grey (9-097).

The choice of control gear was a 250 W solid filled type, with voltage tappings, by Crompton Parkinson, Ltd. Unfortunately no manufacturer could offer polyester-filled gear, which would most probably have been of smaller dimensions and better performance. The G.E.C. capacitor was chosen with a view to good performance, and also having an end-on fixing bracket to achieve a saving in space. The control gear was fitted into relay boxes, each with a single-pole fuse and neutral block.

The bus shelter lighting fittings are of a type made by Fluorel, Ltd., already approved and fitted for landlords' lighting in the Council's flat type dwellings.

Equipment for floodlighting the church consists of two Philips fittings, each with a 250 W fluorescent lamp and internal reflector. The remote control gear is contained in a watertight box concealed in a specially built stone slab enclosure to blend in with the existing stone wall, at a distance of about 4ft from the lamp. The other two fittings are Philips 140 W sodium waterproof floodlighting units with solid filled control gear enclosed in the fitting.

Standard batten type fluorescent fittings with quick-start control gear, each mounted on the sill inside each of the five windows, are employed for the bank lighting. Alongside each fitting is a flush 2 A three-pin ivory socket outlet with fused plug for local protection.

Outside fluorescent lighting is connected by means of remote switch-start control gear and p.v.c. sleeves fitted over the lampholders. All fluorescent lighting equipment was supplied by H. W. Field & Son, Ltd., Harold Wood, Essex.

I have to thank Mr. H. C. Rowley, M.I.C.E., M.I.Mun.E., city engineer, Norwich, for permission to publish this article.

# ARTIFICIAL AND NATURAL LIGHT

## Their Roles in Modern City Buildings

By J. M. WALDRAM, B.Sc., A.M.I.E.E., F.I.E.S.*

**City buildings are restricted by the need to admit daylight to them, yet daylight is unable to reach much of their interiors and is inadequate by today's standards. The attempt to use it as a working light is costly and ineffective. The cost of artificial light has fallen to the point at which it provides an economically interesting substitute and should give greater freedom to the architect in developing sites, though it will always be necessary to provide daylight for amenity and to give a view through windows where appropriate**

A LAYMAN might define town planning as the art of providing as many people as possible with well-balanced amenities on a given site at the minimum cost. It obviously demands a very complex series of compromises between many requirements which must be balanced in different ways according to particular users and different types of district: there is no unique solution, and in a city which has developed over centuries it is usually possible only to see that as rebuilding occurs the city grows as well as can be managed. Nevertheless, it is wise to review even the best established ideas in the light of technical progress, to make sure that we are doing as well as we can. One such point, which was mentioned in the lecture given by Mr. O. W. Humphreys at the British Electrical Power Convention at Torquay,[1] and has been made by others, has attracted attention and is examined in the present article.

Among other things, buildings need heat, light and, if possible, a view; we have taken it for granted that to provide the second and the third the obvious method is to make openings in our walls so that we can let daylight in and see out, making them big enough to admit enough light but not so large that they leak too much heat. After all, daylight is there and costs nothing, and it would be stupid not to make use of it; and for the village of small buildings it is the obviously right solution. There is enough daylight to go round, and if the buildings are not high and the rooms not too deep it will reach the back of them; the necessary streets and gardens give it room.

But when cities grow bigger, when buildings grow higher and deeper and when gardens are crowded out, the situation is different. There is no longer enough daylight to go round, and it will no longer reach to the backs of the rooms on the lower floors. If we seek more by building high we get it at the expense of our neighbours. Modern constructions permit curtain walls which are mostly of glass, but on the lower floors one sees little sky through them, and they complicate the heating problem. To get the daylight in, light wells must be provided, losing thousands of possible rentable square

* Research Laboratories, General Electric Co., Ltd., Wembley.

feet on every floor. A quarter of a century ago it was recognised that light wells work much better on the outside of a building than on the inside,[2] so that buildings tend to become high narrow towers set back from the frontage lines, or separated from much lower sections, which is to everyone's advantage in the matter of light and view, but still means that the site is not developed to the extent that it might be.

Even when the daylight can get in, there remains the problem of getting enough in. When it was considered sufficient to provide 10 lm/sq ft, a sky of 1,000 ft-lamberts would provide it if the daylight factor was 1 per cent, which is possible, though often difficult to achieve, over much of the upper floors in a city. But today we expect 50 lm/sq ft and will doubtless soon be asking for more; across the Atlantic 100 lm/sq ft is common and some buildings boast 500 lm/sq ft. Whether all this is really necessary is another question; but obviously even the modest requirements in Britain today call for daylight factors which are quite out of the question for most interiors, except at positions near the windows or under a skylight.

This means that attempts to rely on daylight in cities for a working light are bound to be costly and unsuccessful. The enclosing of space is becoming more and more expensive; to try to get adequate daylight means that sites are inadequately developed, and buildings made unnecessarily costly; and that the interiors provided at such cost do not after all receive daylight in the necessary quantity over a large part of their area. Moreover, the light is very badly distributed in amount and is too strongly directional. There is little that can be done about it, and when the sky is visible the result only too often is glare. It is pitiful to see buildings in which large windows have been provided and then fitted with blinds to cut down the glare. Recent work by the Building Research Station has shown how daylight can be controlled fairly successfully in such buildings as hospitals and schools, but there the problem is different; there is usually plenty of daylight and much more opportunity for controlling it than in a city building. The effect of large windows on the cost of heating is much debated by the specialists, but there seems little doubt that large windows cost more than walls to build and that they let out more heat than they admit from the sun, so that heating costs rise as their size is increased. Thus, though the daylight is a free issue, it is expensive to collect.

## Drastic Reduction in Cost

The tradition of relying upon daylight goes, of course, back to times when artificial light was almost non-existent and incapable of providing a working light, and even when later it could, it was at first very costly. It has not been fully recognised that artificial light is not merely one of the few things which have not risen in price; it is almost the only commodity which has become incredibly cheaper in the last thirty years. When the present writer began as a lighting engineer in 1923, a 100 W lamp cost 5s, lasted 1,000 hours and gave some 900 lm; energy often cost 6d per kWh. At the value of money today that lamp would have cost at least 15s and energy would have been 1s 6d per kWh. Today an 80 W fluorescent lamp, consuming about 95 W with its auxiliaries, costs 13s without purchase tax; it provides about five times as much light for at least seven times as long, and energy costs about 1½d per kWh. The running cost of light, in energy and lamps, is on this basis about *one sixtieth* what it was in 1923. Adjustments have to be made to cover the fixed charge for energy and the greater capital costs associated with the fluorescent lamp, but even so the cost of artificial light has fallen to a point which justifies a revision of ideas about daylight, artificial light and buildings.

A study of the economics in detail would involve controversial assumptions concerning the finances of building, which are the concern of the economists; but the following very rough figures may form the raw material for discussion.

An office of 1,000 sq ft lighted to 50 lm/sq ft would require thirty 80 W fluorescent lamps, assuming reasonable lighting design and maintenance. If the mean lamp life is 7,000 hours, the price of the lamps being 13s (list, without tax) and the price of energy 1½d per kWh, then the cost of lamps for this space per 1,000 hours is 56s and the cost of energy is 357s, a total of 413s or 0·413s per sq ft per 1,000 hours. Capital costs, cleaning costs and the fixed charge for energy are omitted, since lighting has to be provided anyway for use at night; what matters is the *extra* cost of running it during the day instead of using daylight.

If the lighting is used for 50 hours per week, it will run for 2,600 hours per annum; but during the winter quarter there would be insufficient daylight for, say, three hours a day when artificial lighting would have to be used anyway; the net *extra* burning time per annum becomes 2,400 hours, which at 0·413s per sq ft per 1,000 hours would cost 0·99s or, say, 1s per sq ft per annum.

Building costs for office buildings are about £4 10s per sq ft, which at twenty years' purchase represents 4s 6d per sq ft per annum. Thus, in round figures the annual cost of lighting to 50 lm/sq ft a given area of floor artificially instead of by daylight is rather more than a fifth of the annual value of the cost of building. The rent for such office space is of the order of 15s per sq ft, rising to much higher figures in key situations, so that the cost of artificial light instead of daylight is of the order of one-fifteenth of the rent.

## The Human Aspect

The economics for a given building cannot be pursued further here, for there would be involved the amount of extra floor space which could be provided if daylight were not relied upon for the working light, the amount of floor space which would require artificial light during the day in consequence and the return to be expected from the building as a whole with and without the extra floor space, together with some correction for heating. It is complicated by the fact that even if the attempt is made to provide conventional daylight it will not suffice over large parts of the building so that artificial light will be needed by day over those parts anyway; the extent will depend upon the design of the building and the degree to which its daylight is obstructed by other buildings, present or expected.

However, this problem is wider than economics. From considerations of cost alone it might be concluded that we should build without windows and provide completely artificial light and air conditioning; a horrid idea, dealt with faithfully years ago by E. M. Forster (" The Machine Stops "). We must design for men and women, not " economic units " and " personnel," and people do not like to be cut off from the outer world. We like to see outside where we can; we treasure daylight where we can get it, and are willing to pay higher rents for buildings which enjoy it: clients often demand it. Nevertheless, all buildings require artificial light throughout at night and many use it all day as well over large areas, such as in big stores. Customers are, of course, not usually there long enough to be troubled; but the staff do not seem to be troubled either, provided that they can see out and enjoy daylight in the places where it is reasonable to

expect it. In some factories, and in the Underground, there is necessarily only artificial light and nobody seems to be troubled by the fact so long as it is reasonable that this should be so, and provided that the artificial light is good.

What is suggested is not that we should build without windows, but that we should revise our ideas of building, recognising that we can now provide light independently of windows at an economic cost, so that the building need not necessarily have large light wells or their equivalent carved out of it to provide a working light, provided that so far as possible we have a view. This again does not mean that we should build sites solid and make canyons of the streets; there are other amenities to be provided, such as "townscaping," adequate and dignified streets, proper open spaces, daylight for façades, adequate space for setting fine elevations and many more. Rather it is suggested that the intelligent use of artificial light to provide the working light over most of the enclosed space and to supplement the daylight will give greater freedom in design to develop the site adequately and economically, and so that the enclosed space is all usable as first-class working space.

The point was made earlier that if daylight is to be replaced by artificial lighting, then the artificial lighting must be good. It must be designed to harmonise with the daylight where both are provided in the same room, in level, colour and direction, a matter on which guidance has been given by Hopkinson and Longmore of the Building Research Station.[3] It must provide a pleasant and varied environment and it must be really comfortable without being dull. This means first-rate lighting design and good equipment; it also involves equal care in the design of the decorations, and good maintenance. It is a task in which the lighting engineer and the architect need to co-operate fully from the inception of the building, on the basis that the lighting is as much an integral part of it as the windows, and that careful economic studies are required to make the fullest use of each individual site.

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# NON-DESTRUCTIVE TESTING

FIVE "generations" of atomic reactor development leading to the new advanced gas-cooled reactor with operation temperatures approaching 600°C were described at a recent meeting of the Society of Non-Destructive Examination by Dr. Michael Davis, who is personal assistant to Sir Leonard Owen, member for production, United Kingdom Atomic Energy Authority. In emphasising that a shut-down resulting from either defective materials or fabrication could seriously affect the overall cost of operation, Dr. Davis spoke of the careful inspection which was given to all components.

As a result of these inspection procedures, where material used for can manufacture was ultrasonically examined and every can weld was radiographed, it had been possible to reduce the total of faulty elements to about four per reactor per year, the number of fuel elements in the reactor being of the order of 10,000. There was hope of improving even upon this low figure. A very sensitive device, based on the detection of decaying gaseous fission products, had proved invaluable in giving early warning of a fuel element failure, so that the offending element could be discharged. The required degree of grain orientation in the all-important uranium fuel was also being studied by ultrasonic methods. A novel method for the non-destructive examination of reactor channels was to be seen in the use of closed circuit television, whereby a camera provided with its own $CO_2$ cooling system could be lowered into a channel to inspect the contents and inside surface.

Dr. Davis pointed out that pressure vessels used in nuclear engineering were the largest of their kind in the world and that their production had been possible only because of progress in welding and non-destructive examination. All plates were ultrasonically tested for freedom from lamination and each weld was radiographically examined. Megavoltage radiography was playing a more important part in the examination of the thicker welded vessels. Linear accelerators, which had recently been developed in Britain, were being considered for use on site. The percentage sensitivity obtained when using a high-activity cobalt source on a thick-walled vessel was nearly as good as that given by a linear accelerator but the exposure time was much longer. To justify the greater cost of a linear accelerator, it would be important to exploit its short exposure time when it was employed for the site radiography of pressure vessels.

## Factory Lighting

THE second illustrated paper in the Factory Building Studies series, "The Lighting of Factories," published for the Building Research Station of the Department of Scientific and Industrial Research by H.M. Stationery Office (price 3s 6d), has two sections. The first sets out the general principles of good lighting and the second discusses some of the more important applications of these principles in the design and maintenance of factories, including an assessment of the relative efficiency of various forms of factory fenestration and a brief consideration of designs which rely partially or completely upon artificial lighting during daylight hours.

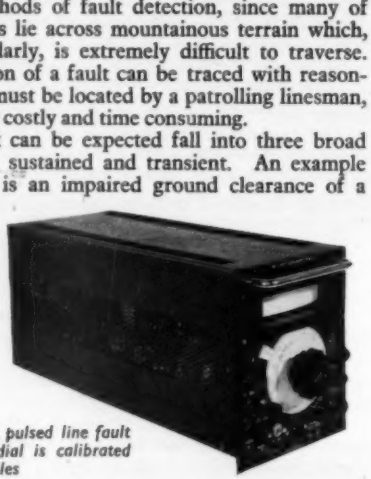
The first section discusses the amount of light required, which in a factory depends upon the object to be seen by the individual operator. Fine detail work, dark coloured work or work having little contrast with the surrounding material or objects necessitates more light. A table of recommended levels of illumination for a wide variety of applications is included. The appearance of colours under various types of artificial light sources, and flicker or stroboscopic effects produced by fluorescent lamps, are also dealt with.

The use of daylight is considered first in the section discussing the practical application of lighting principles, from choosing a natural illumination level to glazing efficiency. The illumination obtained from various lamps and its efficient distribution opens the section on artificial lighting fittings. Screening lamps to avoid glare is then covered; fluorescent and filament lamps should not be visible from an angle less than 45 deg above the horizontal, while local lighting fittings should be chosen to light the work while screening the lamps from direct view. The importance of regular cleaning and lamp replacement is emphasised and the section on the choice of lamps considers colour and rated lamp life, a table of some typical light sources of wattage, life, efficiency and colour being given.

# TRANSMISSION LINE FAULT DETECTOR

AN electronic fault detector has been developed by Ferranti, Ltd., in co-operation with the North of Scotland Hydro-Electric Board to facilitate rapid location of faults occurring on 132 kV grid lines. Development of the detector was initiated by the Board who were interested in electronic methods of fault detection, since many of their 132 kV lines lie across mountainous terrain which, in winter particularly, is extremely difficult to traverse. Unless the position of a fault can be traced with reasonable accuracy, it must be located by a patrolling linesman, which can be very costly and time consuming.

The faults that can be expected fall into three broad categories, latent, sustained and transient. An example of a latent fault is an impaired ground clearance of a conductor, which will not cause flashover at normal voltages, a sustained fault can be produced by a broken conductor or a badly damaged insulator string, and a transient type of fault occurs when lines clash during a high wind, or are struck by lightning. The N.S.H.E.B. have one commonly occurring fault during winter, ice accretion on the lines, which commences as a latent fault, since the conductors merely sag, but eventually develops into a sustained fault when the conductors sag sufficiently to touch the ground or each other.



*On the Ferranti d.c. pulsed line fault locator the range dial is calibrated in miles*

The detector chosen by Ferranti, Ltd., known as a radar type locator, works on the radar principle of pulse reflection, the reflection in this instance being caused by any local variation in line characteristic impedance. The distance to the fault can be found by measuring the time interval between the pulse transmission and the reception of its reflection. These locators can be of the d.c. or a.c. type. In the d.c. type, direct connection is made between the line and the locator. This cannot be connected to a live line and it can, therefore, only detect sustained faults. The a.c. locator is coupled to the live line through some suitable device, usually the coupling capacitor used with the carrier control system, and can detect transient faults at the expense of increased complexity. The d.c. type locators tend to be portable devices, whilst a.c. locators, due to coupling difficulties, usually have to be permanently sited at substations.

## D.C. Locator

The Ferranti d.c. instrument has successfully located staged faults under varying conditions and it is hoped that it will be able to detect the onset of icing conditions on the line before the lines sag sufficiently to touch the ground. This locator, which operates with 1 $\mu$sec d.c. pulses at a pulse repetition frequency of 300/sec, has a designed range of 100 miles and an accuracy in adverse weather conditions of 2 per cent of the total range, improving under good conditions to two span lengths.

Development is proceeding on an a.c. type locator in co-operation with both the South of Scotland Electricity Board and the N.S.H.E.B. to cover fault conditions on both 132 kV and 275 kV lines. The technique for detecting the positions of transient faults involves leaving the equipment normally in a standby condition and switching to the operating state in the few milliseconds between the detection of a fault by the normal line protection equipment and its clearance by the operation of the circuit-breaker. There is no difficulty in attaching these locators to such lower voltage systems as 11 kV and 33 kV lines, though with these lines considerable interpretation difficulties exist due to the many side-spurs which "tee-off," each causing multiple reflections confusing the reflection from the actual fault.

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## *Power Supply in Northern Ireland*

THE next major addition to generating plant of the Electricity Board for Northern Ireland will be the Coolkeeragh (Londonderry) oil-fired station. Referring to the progress of construction in its annual report for the year ended 31st December last, the Board says that although the steelwork erection programme was delayed for some twelve weeks by a shipyard strike, it is expected that the first 30 MW set will be in commission for the coming winter, as planned. A 60 MW extension has already been authorised. At present the main sources of power are the Board's Ballylumford station (124·5 MW) and the East and West stations of Belfast Corporation (174·7 and 240 MW respectively). These three stations, which are coal-fired, are operated conjointly to supply the systems of the two authorities.

| | 1957 | 1958 |
|---|---|---|
| Electricity generated and purchased, million kWh | 599·8 | 657·1 |
| Sales, million kWh | 511·0 | 560·8 |
| Consumers connected at 31st December | 160,025 | 166,188 |
| New consumers | 7,143 | 6,163 |
| Farms supplied | 17,074 | 19,144 |
| Farms connected during year | 1,831 | 2,070 |
| Revenue | £4,470,088 | £4,946,106 |
| Working expenditure | £3,487,771 | £3,935,155 |
| Interest, depreciation, etc. | £855,760 | £1,007,992 |
| Transfers to reserve | £120,000 | — |
| Surplus | £5,182 | £2,959 |
| Average price per kWh sold | 2·07d | 2·09d |
| Sales of appliances | £160,041 | £182,228 |

The main details of the Board's operations are summarised in the accompanying table. The price of coal averaged just over £5 a ton, against £4 15s 6d in 1957, and the average coal clause charge (which is paid by domestic as well as industrial consumers) was 0·346d per kWh (against 0·295d). Sales aggregated 560·8 million kWh, an increase of 9·7 per cent, and the average price obtained was 0·02d higher at 2·09d/kWh. Of the 19,144 farms supplied 16,893 have been connected in the last ten years. Electricity sales to farms have more than doubled since 1955 and now account for 12½ per cent of the total kWh sold by the Board. Following the removal of hire-purchase restrictions in October, electrical appliance sales rose to twice the previous monthly average.

The report states that nuclear power station site investigations undertaken by the Board at the request of the Ministry of Commerce were still in progress at the end of the period under review.

# New Books

**Automation Today and Tomorrow.** By L. Landon Goodman. Pp. 158. Iota Services, Ltd., 38, Farringdon Street, London, E.C.4. Price 40s.

This is a practical book aimed at industrialists and particularly management. In spite of its title it is really automation yesterday in someone's factory, today in your rival's and tomorrow in your own. The message is that automation is very clever and it is more than mass production. The book is a non-technical, non-analytical descriptive work showing what has been achieved in factory and office, and deals with the allied topics of primary importance to management, but not to the engineer and scientist. Such concepts as sales, distribution, warehousing and packaging all command individual chapters.

Split into two parts, the second part is a comprehensive bibliography of the literature on practical automation. This long list of 854 entries is arranged in order of subject matter, sub-divided under such headings as "Plastics," "Rubber," "Steel," "Training" and "Welfare." There are also subject and author indexes. Each item in the bibliography carries with it a brief description of the scope of the article. This should prove invaluable and is a practice which should be encouraged.

In the first half of the book there are seventeen chapters, each on a different topic. The one on automation in specific industries is by far the largest and most important part. It deals with 14 completely differing industries from sugar beet and brewing to motor cars and textiles.

I find it depressing that the author thinks it necessary in the conclusion to warn industry that if they do not employ at least one technically qualified man, they will not have anyone to read the technical reports and papers. Is British industry as bad as all that ?—J.C.W.

**Semiconductors.** Edited by N. B. Hannay. Pp. 767; figs. Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 120s.

This book appears with some weight of authority, being the one hundred and fortieth of the American Chemical Society's series of chemical monographs, and the editor being in charge of chemical physics research on semiconductors at the Bell Telephone Laboratories, one of the world's most important centres of research in this field. Whilst the subject is naturally approached from the chemical point of view, this is a field where chemistry, solid state physics and electronics are closely intermingled; and although the details of experimental techniques and the nature of the devices which are currently fabricated from semiconductor materials are naturally both omitted from the present work, a very great deal of solid state physics is included. The readers for whom it was written are described as being of two kinds: those chemists who have a desire to learn something about a field which is rapidly absorbing more and more chemists; and the chemists, physicists and metallurgists who are actively working in the field, who may find illuminating a treatment of semiconductors which emphasises the chemical aspects of the subject.

There is throughout a heavy emphasis on germanium and silicon; the natural consequence of the overwhelming industrial significance of these two materials and the corresponding scale of research on them. Nevertheless, from the large volume of literature on compound semiconductors a selection has been made of some of the work which appears to be on the soundest basis. It is perhaps surprising that selenium, which still has considerable commercial importance, does not rate for more than a page. This is primarily due to lack of success in the preparation of good single-crystal samples. Indeed, one of the longest chapters in the book is devoted to the techniques of crystal growing, followed by a chapter on the control of composition. Defect interactions and diffusion processes each receive a chapter, as do Group IV semiconductors and the covalent Group III-V, V-VI, and II-IV compounds. The chemistry and semiconducting properties of a range of oxides and sulphides receive attention and a chapter is devoted to organic semiconductors, of which anthracene is the most important. Finally, semiconductor surfaces are discussed, and semiconductor-electrolyte interface, concluding with a brief glance at the etching process which forms the basis of a considerable germanium and silicon technology.

Text figures throughout are numerous and of high quality, as is the general standard of production of what is likely to be a standard work on its subject for many years.—P.L.D.

**Welding Handbook.** 4th edition. Part 1: Principles. Part 2: Welding Processes—Gas, Arc and Resistance. Published by the American Welding Society. Pp. 563 and 632; figs. Cleaver-Hume Press, Ltd., 31, Wright's Lane, London, W.8. Price 72s each.

In these two volumes, the first in a set of five to be published by the American Welding Society, each chapter has been compiled by a committee of experts and is alone most useful, while grouped, they form a worth-while reference text book. For the reader in this country, two chapters need some translation if American practice is not to be followed. For example, the definitions and illustrations of welding jargon are acceptable providing one remembers to make such simple translations as "Town" for "City" in "Oxy-City Gas Cutting." The engineering tables seem comprehensive and while some of the information is extremely useful some is irrelevant to welding. The omission of the Imperial Standard Wire Gauge from a table of comparisons of wire gauges makes one wonder why "A section of land is one mile square," included in the weights and measures table in the first part, should be of significance in a book of this character. The section on welding metallurgy has been tackled very well indeed and the fundamentals are fully covered. There is a natural emphasis on ferrous welding metallurgy with a commendable section on the stainless steels. The non-ferrous side is dealt with briefly but adequately. The dozen paragraphs on titanium and its alloys, for example, are well to the point. The chapter on the properties of welded joints is a little unusual in its composition, although most of the technical matter is sound.

The thermal and mechanical treatment of "weldments" is covered and tables of recommended treatments for A.S.T.M. and A.I.S.I. steels are included. There is a chapter on joint design which deals with the factors involved in designing an efficient joint with a view to economy as well as satisfactory mechanical properties and corrosion resistance. A chapter on costing indicates the factors involved and their respective effects on final costs. Tables and nomographs are included to enable simple

calculations of welding costs to be made. After outlining the principles of welding inspection, the type of defects to be encountered are dealt with and illustrated, and the methods of inspection and testing available for their detection are described. Mechanical testing as an inspection method is treated to a separate chapter and the testing of butt welds and fillet welds of several types is considered separately. To complete Part 1 of the series there are chapters dealing with statistical weld quality control and safe practices in welding and cutting.

The second volume in the series has as its subject welding processes, comprising three main sections: gas, arc and resistance methods of welding. These sub-divide into chapters covering the details and variables of the processes, and chapters dealing with the equipment involved in the various processes.

A large section of this part is devoted to arc welding, with chapters on carbon arc, shielded metal arc, bare metal arc, impregnated tape metal arc, atomic hydrogen, inert gas shielded metal arc and submerged arc welding. A chapter on arc welding equipment covers the wide range available in a concise manner.

Resistance welding methods and equipment are adequately dealt with in three chapters, and the final chapter on welding symbols is comprehensive in its treatment of American standard symbols. This, of course, is not of direct use in this country, but well illustrates the logical use of symbols.

Both volumes are well produced, and the American Welding Society's statement that this fourth edition is "completely recast" might well include the qualification "and refined."—F.W.

**Wiring Circuits.** 2nd edition. Edited by E. Molloy. Pp. 231; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 12s 6d.

A number of new diagrams have been incorporated in the latest edition of this book, first published in 1951, and it has been revised in accordance with the latest wiring regulations. The systems of supply for domestic and industrial premises are shown in the opening chapter, including the use of the ring circuit for socket outlets, and in the following chapters interior lighting controls and electric sign circuits, including time switches, alarm and indicator circuits, are dealt with in detail. The next sections are devoted to motors and motor control circuits, transformers and rotary convertors, voltage regulators, rectifiers and battery charging equipment, information useful to the engineer concerned with industrial installations. Other chapters deal with lift and crane control, thermostatic control of water and space heating, and electronic and other special circuits, while the concluding chapter covers the various circuits used in electric welding equipment.

The book is intended to be a reference work for electrical contractors, installation and maintenance engineers, and is copiously illustrated with circuit diagrams and drawings showing the physical arrangement of equipment.—T.R.W.

**The Cathode-Ray Tube and its Applications.** By G. Parr and O. H. Davie. 3rd edition. Pp. 433; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 50s.

The third edition of this well-known book has been revised, according to the original plan, to serve as a guide to the operation and use of the cathode-ray tube as a versatile measuring instrument. Those applications rarely encountered by most users are ignored. There are sixteen chapters. The first eight, comprising roughly 60 per cent of the book, deal with the tube itself and the ancillary power supplies, amplifiers, time-bases, etc. The second group of chapters deals with applications. After descriptions of photographic recording techniques and transducers, there are chapters on applications in electrical and mechanical engineering, radio engineering and television measurements, applications in general and in nuclear physics and such miscellaneous applications as medicine and physiology.

The descriptions of the behaviour of the tube and circuits are mainly qualitative, but copious references to the original papers ensure that design details can be located when required. Few errors have been noted but a rather fundamental one occurs in the description of the operation of a magnetic lens. I should have liked to have seen a fuller account of the travelling-wave deflection system, which has been dramatically successful in extending the frequency limits for direct observation to the kilomegacycle region. But these criticisms are of minor importance.

The book is well printed, freely illustrated with legible circuit diagrams and photographs of displays. It can be thoroughly recommended to anyone seeking to make the best use of cathode-ray tubes.—A.H.B.

**From Microphone to Ear.** 2nd edition. By G. Slot. Pp. 258; figs. Philips' Technical Library, Eindhoven, Holland. Distributed in the United Kingdom and Eire by Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 21s.

In this book the entire sequence of sound recording and reproduction from the microphone to the loudspeaker is discussed in a manner understandable by readers not having technical training, for the book has been written for them as much as for trained technicians. Particular attention has been paid to the factors which ultimately affect reproduction quality or which are of importance when new equipment is bought. There are chapters covering recording and record manufacture and the principal features and utilisation of pickups, record players, record changers, tape recorders, amplifiers and loudspeakers. In this latest edition, the book was first published in 1956, a chapter has been included devoted to stereophonic sound, a number of illustrations have been replaced and 24 new ones added.—T.R.W.

**The Modern Diesel.** Automotive Oil Engines for Transport, Marine and Industrial Use. 13th edition. By D. H. Smith. Pp. 288; figs. 243. Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 17s 6d.

The latest trends in fuel induction practice, combustion chamber design and fuel and lubricant developments are reviewed in the new edition, which gives detailed information on the characteristics of current diesel engines available for transport and industrial use. The engines of over 70 manufacturers from 11 countries are described.

## BOOKS RECEIVED

**Mathematics for Telecommunication Engineers.** by S. J. Cotton. Pp. 245; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 37s 6d.

**Progress in Nuclear Energy.** Series VIII. The Economics of Nuclear Power. Vol. II. Edited by I. R. Maxwell, P. W. Mummery and P. Sporn. Pp. 419; figs. Pergamon Press, Ltd., 4 & 5, Fitzroy Square, London, W.1. Price £5 5s.

**Enzyklopädie der Energiewirtschaft.** Volume II. By Max Wolf. Pp. 563; figs. 473. Springer-Verlag, Berlin-Wilmersdorf, Heidelberger Platz 3 (West Berlin), Germany. Price DM 97.50.

# Success or Failure in the H.N.C.

## Assessment of H.N.C. Potential from O.N.C. Results

By J. F. YATES, M.Sc., B.Sc., M.I.E.E.*

IT is well known by both industry and the technical colleges that many students who obtain the Ordinary National Certificate fail to obtain the Higher National Certificate even after several attempts. It is desirable that student, college and industry should all make a wise assessment of the student's potential regarding the H.N.C. when the O.N.C. has been obtained, and adopt or advise a suitable alternative (such as a craft or City and Guilds technician course) when the prospects of Higher Certificate success seem remote. This would (a) avert undue strain on and disappointment to students who have reached or nearly reached their "ceiling" with the passing of the O.N.C. examinations, (b) use the staff and equipment of the technical colleges to the best advantage, and (c) make the best use of day release from industry.

It is obvious that psychologically as well as practically, success in the alternative course is preferable to repeated failure in the H.N.C. course. It is not always an easy task, however, to persuade students (and sometimes employers) that taking the recommended alternative course is a wise step. Natural ambition still continues to drive some students to many years of hard endeavour ending too often in frustration.

Mr. A. J. Jenkinson, principal of the Bolton Technical College, has made suggestions for assessing the H.N.C. potential of mechanical engineering students holding the Ordinary Certificate in an article published in "Vocational Aspect No. 20, Spring 1958" entitled "S3 Examinations in Mechanical Engineering—their Prognostic and Diagnostic Values." This contains an analysis of the records of 98 students both before and subsequent to their Ordinary Certificate success. Two of his conclusions are particularly interesting, namely:—

(1) A pass with an aggregate mark of 170 [for three subjects] or above suggests success in H.N.C. even if the student has failed on the way to O.N.C. (i.e. in S2 or S3).

(2) A pass with an aggregate mark of less than 170 suggests that the student should not proceed with H.N.C., but should seek some other course, though he may with some hope attempt H.N.C. if he has not failed on the way to O.N.C. (i.e. in S1, S2 or S3).

Another interesting fact which emerges from his analysis is the predominant success of that section of the students which had previously attended secondary technical schools, as compared with grammar and secondary modern schools.

The experience of many teachers of electrical engineering will lead them to suspect that an analysis of the National Certificate results in electrical engineering would probably produce somewhat similar suggestions. Accordingly, records from three technical colleges, spread over a fairly wide area, were examined. The records covered three academic years. It should be noted that these records were only for those students who had obtained both their Ordinary and Higher Certificates at the one college. Such students form only a part of the successful H.N.C. students at these colleges as each H.N.C. course is also fed with students holding the O.N.C. from other colleges. Also, each college had numbers of successful O.N.C. students whose job, national service, or other reasons caused them to continue their H.N.C. studies elsewhere or who abandoned further study for a variety of reasons. Thus the number of successful H.N.C. candidates examined here is only 113, but it is hoped that the results are reasonably representative.

| College | H.N.C. Exam. Year | Passing H.N.C. | Number of Successful Candidates | | | |
|---|---|---|---|---|---|---|
| | | | With more than 60% O.N.C. av. marks | With less than 50% O.N.C. av. marks | With more than 60% maths. marks | With less than 50% maths. marks |
| A | 1958 | 12 | 8 | 0 | 8 | 2 |
| | 1957 | 13 | 13 | 0 | 12 | 1 |
| | 1956 | 26 | 22 | 0 | 16 | 3 |
| B | 1958 | 10 | 7 | 0 | 6 | 1 |
| | 1957 | 9 | 6 | 1 | 4 | 3 |
| | 1956 | 8 | 6 | 1 | 5 | 3 |
| C | 1958 | 10 | 8 | 0 | 7 | 0 |
| | 1957 | 9 | 7 | 0 | 9 | 0 |
| | 1956 | 16 | 11 | 3 | 11 | 1 |
| | | 113 | 88 | 5 | 78 | 14 |
| | | | 78% | 4·4% | 69% | 12·4% |

The most important points shown by the table are that:

(1) Approximately eight out of nine successful H.N.C. candidates obtained an average of more than 60 per cent in the O.N.C. examinations.

(2) Only one in about 23 successful H.N.C. candidates passed with an average mark of less than 50 per cent in the O.N.C. which is the level qualifying for the "credit" required by the Institution of Electrical Engineers for individual subjects when these subjects are being considered for exemption from the Institution's graduate membership examinations. Half of these H.N.C. successes had repeated some part of the whole course—mostly part of the Higher course—although full information was not available in this respect.

It is often considered that the subject of mathematics is one of the worst obstacles in the O.N.C. examinations in electrical engineering. It certainly appears from the table above that the O.N.C. mathematics marks obtained by the successful H.N.C. candidates are fairly high. Thus approximately seven out of ten successful H.N.C. students obtained more than 60 per cent mathematics marks in the O.N.C. Of these seven, approximately three had more than 80 per cent or 90 per cent. Only one out of eight successful H.N.C. students obtained less than 50 per cent mathematics marks in O.N.C. Mathematics is perhaps a little more important to the electrical engineer than to his opposite number in mechanical engineering, and it certainly seems necessary to consider the mathematics marks in addition to the average mark.

### Conclusion

Thus the successful O.N.C. student, his college adviser and his industrial training officer should look carefully at the level of the overall average O.N.C. mark and also

* Formerly Head of Electrical Engineering Department, Salford Royal Technical College.

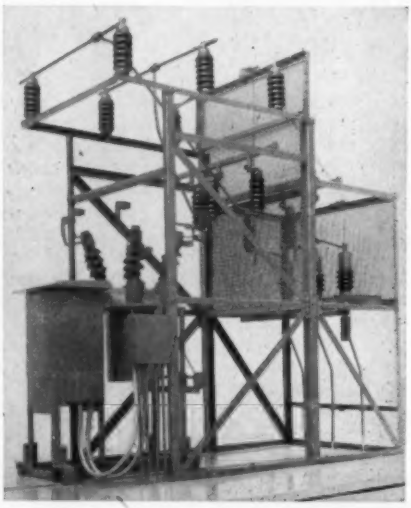
that obtained in mathematics. An overall O.N.C. average and a mathematics mark of 60 per cent would appear to be a reasonable basis on which to expect H.N.C. success. It will, of course, still be necessary to carefully consider somewhat lower results. Such factors as the student's possible temporary difficulties, his background, a lower average mark offset by exceptionally high mathematical marks and vice versa, may justify proceeding to the Higher course, but it is suggested that the 60 per cent level is the kind of reference line from which advice is generally given and taken.

## New Switchgear and Transformers

A NEW range of distribution transformers has been developed by South Wales Switchgear, Ltd., Blackwood, Monmouthshire, in which a departure has been made from the traditional method of cooling. Instead of the usual double bent tubes welded directly into the transformer tank, a simple design of radiator is employed which has advantages both from the manufacturing and operational points of view.

Each radiator consists of four vertical elliptical tubes running into top and bottom round headers. The assembly is brazed together in a precision jig and then chemically cleaned for painting. The completed radiators are externally welded to the tank body. Such radiators have good cooling characteristics and less footage of tube is required than with the conventional method. The radiators can be spaced at a reasonable distance apart round the tank with ample room between for brush painting on site, should it be required. Owing to the accessibility it is now also possible to have such a tank zinc sprayed before painting.

Another introduction by the company is the open type 33 kV packaged switchgear for service up to 1,000 MVA. In this equipment the oil circuit-breaker is isolated from the fixed portion which carries the busbar and feeder connections by racking out horizontally. The unit is a complete substation in itself and is aligned in the factory so that the time taken in erection on site is kept to the minimum.



*South Wales Switchgear open type 33 kV packaged substation with o.c.b. racked out into the isolator position*

# Engineering in Europe

MAGNETIC amplifiers are usually designed from the effective values of voltages and currents. However, in circuits with semiconductor-type rectifiers and resistive and inductive loads the voltage across the working windings of the amplifier differs considerably from a sinusoid. It is therefore necessary to know the form factor of the e.m.f. of self-induction for any concrete operating conditions, i.e. to have the characteristics $B_m=f(H_1H_-)$ and corresponding curve sets $k_f=f_1(H_1H_-)$. On the other hand, the mean values of the e.m.f. of self-induction are unambiguously related to the flux density, and their introduction considerably simplifies the calculation of magnetic amplifier circuits.

These calculations are shown for circuits with linear and non-linear inductances connected to the input of the rectifier bridge and the procedure for determining the main parameters of the magnetic amplifiers is demonstrated. The circuit contains relatively large load inductances ($\omega L_e > 5r_e$), this being frequently the case in practice. The examples solved refer to a linear inductance at the input side of the rectifier, a circuit with the magnetic amplifier at the input side of the rectifiers, without and with direct feedback. In an appendix, the form factors for the cases of sinusoidal current and sinusoidal voltage at the rectifier input are determined. The main results of the calculations are checked by oscillograms of the operation of the actual circuits. — "Designing Magnetic Amplifiers with a Resistive and Inductive Rectified Load," A. G. Zdrok, *Elektrichestvo*, No. 5, pp. 25-31, 1959, in Russian.

### Rectifier Ignition Currents

High-frequency oscillations are set up at the instant of ignition of valves in powerful convertor installations, and these render the operation of the plant more difficult. The oscillations result in voltage waves with steep fronts, and covering a wide frequency spectrum, being propagated through the busbar system and causing damped oscillations in all the circuits formed by the capacitances and inductances of the equipment. If the damping in these circuits is insufficient, the amplitudes of the h.f. oscillations may reach dangerous values. If they are superposed on the anode voltages of valves not under commutation at that moment they increase the dangers of arcback and forward breakdown.

In the operating valves the oscillations may cause untimely arc extinction or interrupted ignition. The latter phenomenon is mostly corrected by an appropriately chosen anode reactor, but the selection of this reactor can only be correct if the possibility and the characteristics of the h.f. oscillations are correctly considered. This is the purpose of the analysis of the phenomenon carried out in this paper. The experimental investigation was carried out on equipment of the Kashira-Moscow d.c. transmission system and in the D.C. Research Institute. The very involved calculations (a characteristic equation is of the 8th order and involves 34 terms) are shown to be greatly simplified by the introduction of Sturm's functions and the resulting frequencies are in good agreement with the measured values.—"Calculation of the Oscillatory Components of the Valve Current upon Ignition in a Rectifier Bridge Circuit," L. A. Vakhrameev, A. M. Ryvkin, *Izv. Akad. Nauk, Otdel Tekhn. Nauk*, No. 2, pp. 87-92, 1959, in Russian.

**Readers who require accurate full translations of these abstracts can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.**

# NEW ELECTRICAL EQUIPMENT

## Desk Light

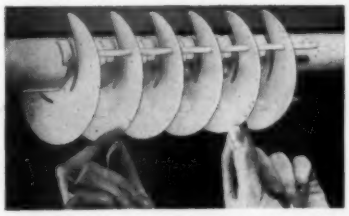
A new desk light which embodies two 6 W 9in standard fluorescent tubes is now being manufactured by J. B. ELECTRIC, LTD., 197-199, Manchester Road, Altrincham, Cheshire. The tubes are mounted in a stove enamelled canopy and reflector, which is supported by a 12in flexible arm and a 7in pillar from a heavy cast base. The ballast unit and switch is contained in the base.

For machine lighting the base and support pillar can be replaced by a remote mounting ballast container. Both types of fitting are finished in black and chromium. They are guaranteed for one year and the prices are £7 15s (desk light) and £7 18s (machine light).

## Lighting Fittings

The new "Louvre-Set" plastic fitting for fluorescent tubes, recently introduced by ROWLANDS ELECTRICAL ACCESSORIES, LTD., Hockley Hill, Birmingham, 18, is available in six sections and comprises complete coverage for a 5ft tube. They are produced in a choice of translucent opal or translucent peach plastic material, the latter colour being especially suitable for use with "warm white" tubes. When fitted, the set has no protruding side members and light absorption is claimed to be virtually negligible. Prices, per set, range from £1 2s for 4ft tubes to £1 6s for 5ft tubes, plus purchase tax.

*Rowlands Electrical Accessories "Louvre-Set" fluorescent tube fitting*



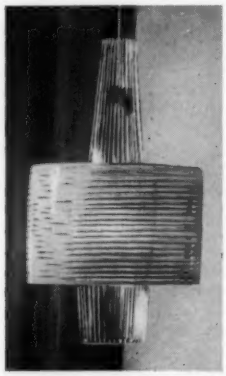
*J. B. Electric twin miniature fluorescent lighting unit*

Three new lighting fittings for general use are now being marketed by TROUGHTON & YOUNG (LIGHTING), LTD., 143, Knightsbridge, London, S.W.1. All glassware is British made, three-ply, with a satin-opal finish to reduce glare and give an efficient and even light distribution. The range includes two pendants with silver or gilt anodised aluminium suspension and a ceiling fitting with no visible metalwork. The respective prices and sizes of the three fittings are as follows: — Pendant U.53 (14in diameter), £2 12s plus 9s 9d purchase tax; pendant U.54 (17in diameter), £4 4s plus 15s 9d purchase tax; and ceiling fitting U.52 (14in diameter), £7 2s plus 7s 11d purchase tax.

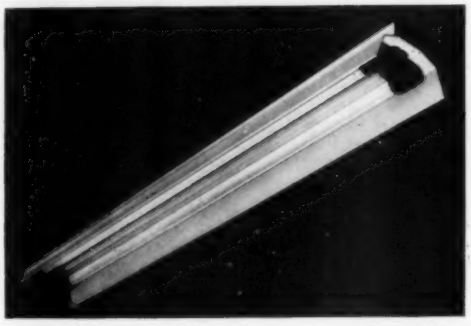
Illuminating glassware produced by Peill & Putzler Glassworks, Dueren, is now being handled in this country by WALTER LOGAN & CO., LTD., 34, Oak Tree Drive, Totteridge, London, N.20. Several fittings are included in the range, which is claimed to have created a new style in lighting glassware and combines pleasing form with good light output.

For fitting manufacturers who wish to incorporate glass in their fittings to overcome design difficulties arising from different techniques in metal and glass, an advisory service is provided by the manufacturers.

*"Venezia" fitting from the Peill & Putzler range (Walter Logan & Co., Ltd.)*

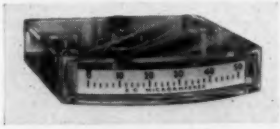


*Simplex anti-corrosion fluorescent fitting for slaughterhouses*



## Miniature Meter

A miniature edgewise meter for use in control panels where front space is limited is offered by TAYLOR ELECTRICAL INSTRUMENTS, LTD., Montrose Avenue, Slough. Several meters can be mounted close together to facilitate comparative readings and when mounted in this manner the readings



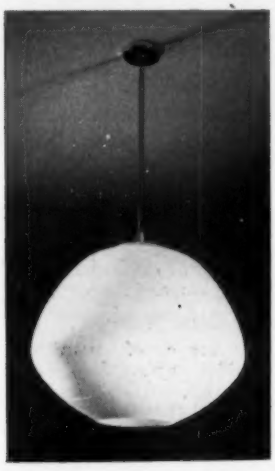
*Taylor miniature meter*

are unaffected by the presence of other meters, ferrous material or magnetic fields, as the basic movement is of the centre pole design, providing inherent magnetic shielding. The Model 220 meter can be supplied as a d.c. voltmeter, milliammeter and microammeter and this model can also be supplied with a rectifier for operation on a.c. supplies. The meters are available with right- or left-hand, displaced or centre zero position and are suitable for either horizontal or vertical mounting.

## Anti-Corrosion Fluorescent Fitting

To meet the requirements of the new regulations on artificial lighting in slaughterhouses, new anti-corrosion fluorescent fittings have been produced by the SIMPLEX ELECTRIC CO., LTD.,

*Troughton & Young model U.54 pendant lighting fitting*



Broadwell, Oldbury, Birmingham. They are available in twin and single lamp fittings and provide a high level of illumination. Being protected by a specially patented process, they are claimed not to rust and can be hosed down when cleaning is necessary. Reflectors, if required, are easily fitted or if reflector tubes are used, they may be rotated in the lampholders to give angled light projection. The fittings are guaranteed for three years and prices range from £7 19s.

### Infra-Red Bolometer

Hot spots in machinery and equipment which cannot be approached to use other types of instruments, e.g. rotating machinery or faulty joints in energised high voltage cables, can be detected by the bolometer operating on a change of resistance produced in a strip of gold leaf when exposed to infra-red radiation, developed by H. TINSLEY & CO., LTD., Werndee Hall, South Norwood, London, S.E.25.

The strip, held by three supports, forms two arms of a Wheatstone bridge network, making electrical contact at the points of support. The other two arms comprise a pair of fixed ratios with a slidewire resistance connected between them which can be

*Tinsley bolometer*

adjusted to balance the bridge. The detector points of the bridge, which is energised by a 1 kc/s transistor oscillator, are connected through an amplifier to a pair of headphones and the bridge may be balanced by adjusting the slidewire until there is silence in the phones. The scale on the slidewire can be calibrated in terms of the energy entering the meter.

### Transistor Holders

A range of transistor holders moulded in p.v.c. for clipping transistors to printed circuit boards or a conventional chassis has been introduced by HELLERMANN, LTD., Crawley, Sussex. Four sizes of the holder, which offers the additional advantage of insulating the metal can of the transistor, are available to suit panel thicknesses of $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$ and $\frac{1}{8}$in.

### Electrode Steam Boiler

The range of medium voltage electrode steam boilers made by BASTIAN & ALLEN, LTD., Ferndale Terrace, Harrow, Middlesex, has recently been extended by the introduction of a larger unit. The new boiler, list No. 680, has a maximum rating of 2,150 kW on a 415 V, three-phase, 50 c/s supply, equivalent to a steam output of 7,070 lb/hr. The boiler is 95in high, with an outside diameter over the lagging of 44in.

*Bastian & Allen electrode boiler*

### Mould Release Agents

Four mould release agents manufactured by Lange & Seidel of Nuremberg are being marketed in this country by CHARLES H. WINDSCHUEGL, LTD., 1, Leadenhall Street, London, E.C.3. These "Lusin" agents are KE 10, a universal agent, KE 195 for glass clear mouldings and phenolic resins, KE 200 for polyesters and epoxide resins and KE 400 for the separation of reinforced plastics manufactured under conditions of heat and pressure. The KE 10 agent is suitable for such electrical parts as plastic switch housings and accumulator cases and also insulating parts for both high and low frequency components which require perfect surfaces to prevent leakages due to hairline cracks or other imperfections.

## *Domestic Dish Washing Machine*

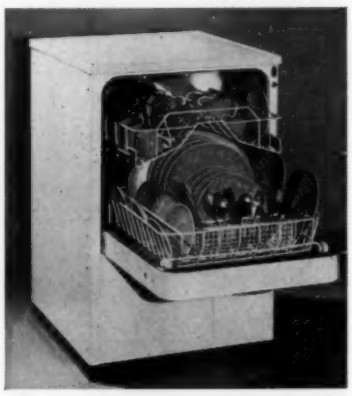
A domestic dish washer, claimed to be the only British-made machine of its kind with provision for loading from the front, has just been introduced by BULPITT & SONS, LTD., St. Georges Works, Icknield Street, Birmingham, 18. A completely automatic machine, the "Swanmaid" is simple to operate, a single button switch being the only control. The advantages of front loading are that there are no heavy baskets to lift, it being necessary only to slide its plastic covered roller tracks forward, when they can be easily loaded without the possibility of damage to fragile china and glass. Once the operating button is pressed and the door closed nothing more has to be done.

Water in a 1 gal tank is heated by a 3 kW unit and when it reaches a temperature of 180°F a thermostatic control switches the machine into a timed cycle, one hot cleansing wash and two hot water rinses. This cleaning cycle is completed in about fifteen minutes, an indication being given when a red pilot light goes out. The temperature of the china and cutlery is brought up to a sufficiently high degree during the cleaning operation to ensure that it will dry off naturally within the cabinet.

Two filters are fitted in the sump of the machine and the washing water is continuously filtered as it re-circulates through the pump and over the dishes. The waste outlet is non-clogging and, because there is no valve, food particles cannot be trapped in a valve seating. The vitreous enamel interior of the and revolving jet arm can be easily removed for cleaning at approximately monthly intervals. The "Swanmaid" dish washer consumes three gallons of water per cycle and it is necessary for it to be plumbed with a ½in water inlet connection, preferably to a static hot water supply giving a constant low pressure head. Apart from electrical connections, the only other requirement is that it must be fitted with a 1in diameter waste outlet.

The complete unit measures 36in high by 22⅞in wide by 24½in deep and the door opens to 18½in. The exterior finish is stove enamelled in ivory or white and the top is vitreous enamelled. It is guaranteed for twelve months and service facilities are available. The price is £123 10s including £18 17s 10d purchase tax.

*This view of the Bulpitt "Swanmaid" automatic dish washer gives an indication of the amount of cutlery and china which can be accommodated at one time*



# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2*

**1946**

3387. Zinn, W. H.—Neutron detector. 2nd February, 1946. (817753.)

5513. Fermi, E., and Leverett, M. C.—Nuclear reactor. 21st February, 1946. (817754.)

12575. Creutz, E. C., and Zinn, W. H.—Control device for a nuclear reactor. 25th April, 1946. (817756.)

13963. Thomson, Sir G. P., and Blackman, M.—Gas discharge apparatus for thermonuclear reactors. 8th May, 1947. (817681.)

14251. Goett, J. J.—Reactor control. 10th May, 1946. (817755.)

**1954**

19486. Siemens Edison Swan, Ltd.—Automatic exchange systems. 23rd December, 1955. (817421.)

20488. Elliston, E. R. (representative of Elliston, D. E.).—Electrically operated hydraulic power units. 13th July, 1955. (817361.)

22562. Holophane, Ltd.—Light transmitting and controlling fittings. 2nd August, 1955. (817791.)

26145. Rank Cintel, Ltd.—Photoelectric detection systems. 8th September, 1955. (817467.)

30191. Allardyce, T.—Underground cable protection covers. 20th October, 1955. (817757.)

32149. English Electric Co., Ltd.—Electrical control systems. 4th November, 1955. (817671.)

32228. Parsons & Co., Ltd., C. A.—Gas turbine plants. 21st October, 1955. (817591.)

34376. British Thomson-Houston Co., Ltd.—Detection and measurement of the frequency of vibration of vibratory bodies. 25th November, 1955. (817683.)

34446. Electric & Musical Industries, Ltd.—Devices having windows for transferring high frequency energy. 4th November, 1955. (817324.)

**1955**

8003. British Dielectric Research, Ltd.—Electrolytic capacitors. 19th March, 1956. (817892.)

10253. English Electric Co., Ltd.—Fluid-blast electric circuit-breakers. 5th April, 1956. (817611.)

10318. British Thomson-Houston Co., Ltd.—Dynamic braking of induction motors. 6th April, 1956. (817572.)

12308. Siemens Edison Swan, Ltd.—Semiconductor devices. 25th April, 1956. (817952.)

17221. Cole, Ltd., E. K., and Davis, R. G.—Beta ray measuring gauges. 14th June, 1956. (817593.)

20822. Speroni, G.—Cable terminating and connecting devices for telegraph and telephone cables. 19th July, 1955. (817781.)

21178. British Thomson-Houston Co., Ltd.—Electric lamps. 27th June, 1956. (817601.)

26466. Sangamo Weston, Ltd.—Apparatus for determining the frequency response of an electronic circuit. 15th September, 1955. (817633.)

27922. Landis & Gyr A.G.—Summation device for determining apparent electrical energy consumption from the indications of an effective consumption meter and a wattless consumption meter. 30th September, 1955. (817537.)

28644. Sylvania Electric Products, Inc.—Fluorescent screens. 7th October, 1955. (817760.)

28958. Union Chimique Belge S.A.—Electrically operated control means for coke oven machinery. 11th October, 1955. (817575.)

29284. Soc. Technique pour l'Industrie Nouvelle Soc. Anon. Stin.—Agreement of the positions of controlled relay contacts with those of a controlling switching member. 14th October, 1955. (817278.)

29596. Sangamo Weston, Ltd.—Electronic frequency calibrating devices. 17th October, 1955. (817821.)

30186. General Electric Co.—Microwave oscillators. 21st October, 1955. (817279.)

30524. Radio Corporation of America.—Magnetic device of the transfluxor type. 25th October, 1955. (817252.)

30702. Cole, Ltd., E. K., and Pichal, H. T.—Television receivers. 29th October, 1956. (817267.)

30921. Sangamo Weston, Ltd.—Electric signal generators. 28th October, 1955. (817822.)

31378. British Thomson-Houston Co., Ltd.—Circuit-breaker operating mechanisms. 8th January, 1957. (817612.)

32000. N.S.F. Nürnberger Schraubenfabrik und Elektrowerk G.m.b.H.—High frequency tuning unit. 9th November, 1955. (817330.)

32352. General Electric Co.—Clothes washers. 11th November, 1955. (817801.)

32353. General Electric Co.—Centrifugal pumps particularly suitable for clothes washing machines. 11th November, 1955. (817802.)

33711. Brown, Boveri & Co. A.G.—Control of gas turbine plants. 24th November, 1955. (817931.)

35810. Metal-Lux S.R.L.—Variable potentiometers. 13th December, 1955. (817483.)

36123. General Electric Co.—Transistor circuit arrangements. 16th December, 1955. (817958.)

36448. Ballantine Laboratories, Inc.—Low level wide band voltage measurement system. 20th December, 1955. (817331.)

36877. General Electric Co.—Heat pump installations. 23rd December, 1955. (817865.)

36878. General Electric Co.—Semiconductor networks. 23rd December, 1955. (817268.) 37266. Transistor amplifiers. 29th December, 1955. (817484.) 37269. Electron discharge devices. 29th December, 1955. (817283.)

36993. Sylvania Electric Products, Inc.—Cathode-ray scanning systems. 23rd December, 1955. (817762.)

37497/8/9/500. General Electric Co., Ltd.—Metal vapour electric arc convertors. 31st December, 1956. (817501/2/3/4.)

**1956**

1119. British Thomson-Houston Co., Ltd.—Air or other gas blast circuit-breakers for electric traction equipments. 12th April, 1957. (817782.)

1126. British Broadcasting Corporation.—Electronic information storage. 6th December, 1956. (817576.)

1264. General Electric Co., Ltd.—Metal vapour electric arc convertors. 14th January, 1957. (817505.)

3466. Standard Telephones & Cables, Ltd.—Switching systems applicable particularly to group selection in automatic telephony systems. 3rd February, 1956. (817959.)

3813. Licentia Patent-Verwaltungs-G.m.b.H.—Electric current converting system. 7th February, 1956. (817703.) 3814. Electric circuit-breaker. 7th February, 1956. (817898.)

3949. British Thomson-Houston Co., Ltd.—Electrical computing apparatus. 6th February, 1957. (817960.)

4091. Compagnie Française Thomson-Houston.—Radio relays. 9th February, 1956. (817713.)

4824. Plessey Co., Ltd.—Variable resistors or potentiometers. 14th February, 1957. (817284.)

7068. Kokusai Denshin Denwa Co., Ltd.—Electric reactors. 6th March, 1956. (817398.)

7121. Imperial Chemical Industries, Ltd., Batty, J. W., Henshall, A. E., and Sagar, H.—Process for preventing the accumulation of electrostatic charges on synthetic fibres composed of polyamides or of polyethylene terephthalate. 13th February, 1957. (817355.)

7663. Metropolitan-Vickers Electrical Co., Ltd.—Flameproof electric switchgear. 12th June, 1957. (Addition to 727664.) (817804.)

8985. Compagnie Française Thomson-Houston.—High frequency electrical circuit arrangements. 22nd March, 1956. (817740.)

9701. General Electric Co.—Electromagnetic core assemblies such as for transformers. 28th March, 1956. (817218.)

9826. Belling & Lee, Ltd.—Electrical filter networks. 8th February, 1957. (817962.)

9920/1. Vltavsky, M.—Electric resistance seam welding machines. 29th March, 1956. (817424/5.)

10592. Soc. d'Electronique et d'Automatisme.—Electronic switches and analogue computers incorporating same. 6th April, 1956. (817901.)

11718. Radio Corporation of America.—Magnetic and ferroelectric counting and registering devices. 17th April, 1956. (817764.)

12174. British Thomson-Houston Co., Ltd.—Electric control systems. 12th April, 1957. (817726.)

12400. General Electric Co., Ltd.—Metal vapour electric arc convertors. 17th April. 1957. (817506.)

13767. Harding, T. B., and Middleton, J. D.—Printed circuit assemblies. 6th May, 1957. (817635.)

14179. Siemens-Schuckertwerke A.G.—Methods for measuring magnetic fields. 7th May, 1956. (Addition to 759047.) (817553.)

14977. General Electric Co., Ltd.—Glass compositions and glass-to-metal seals. 14th May, 1957. (817636.)

15166. Atvidabergs Industrier A.B.—Electrodynamic recording apparatus. 15th May, 1956. (817290.)

16192. Electric & Musical Industries, Ltd.—Tuning circuits for operation at very high frequencies. 27th May, 1957. (817903.)

18478. Hutchings, E. L.—Lampholders for electric lamps. 12th September, 1957. (817578.)

20941. Cole, Ltd., E. K., and Pichal, H. T.—Screening of radio frequency transformers and the like. 8th July, 1957. (817580.)

21016. Western Electric Co., Inc.—Semiconductor circuit controlling devices. 6th July, 1956. (817906.)

21332. Western Electric Co., Inc.—Electric circuit controlling devices utilising semiconductor bodies. 10th July, 1956. (817905.)

21694. Minister of Supply.—Electromagnetic wave aerials. 8th October, 1957. (817742.)

25273. General Electric Co., Ltd.—Electrical devices and terminal caps therefor. 2nd August, 1957. (817908.)

25642. General Electric Co., Ltd.—Thermo-electric devices. 22nd August, 1957. (817909.)

27175. Philips' Gloeilampenfabrieken N.V.—Method of manufacturing heat regener-

*[Continued overleaf*

## NEW PATENTS (*continued*)

ators, regenerators manufactured by this method and device for carrying out this method. 5th September, 1956. (817938.)

27291. Revo Electric Co., Ltd.—Electric lighting fittings. 4th September, 1957. (817816.)

28071. Glover & Co., Ltd., W. T.—Electric cables. 12th September, 1957. (Addition to 625512.) (817616.)

28144. Standard Telephones & Cables, Ltd.—Calculating means. 14th September, 1956. (Addition to 777286.) (817597.)

34487. Chamberlain & Hookham, Ltd., Deacon, L. O., and Lewis, H. S.—Electrical transformers. 7th November, 1957. (817968.)

38719. Collins Radio Co.—Circuit for selecting both upper and lower sidebands. 19th December, 1956. (817696.)

**1957**

946. Cooke & Co., Ltd., H. S.—Electrical contacts. 6th January, 1958. (817914.)

1061. Lyons, W.—Electronic amplifiers. 23rd October, 1957. (817717.) 1062. Sound transmitting apparatus. 18th October, 1957. (817773.)

3012. Collins Radio Co.—Electronic detecting systems. 28th January, 1957. (817663.)

3938. British Thomson-Houston Co., Ltd.—Earth fault protection for electrical equipment. 31st December, 1957. (817878.)

6215. English Electric Co., Ltd.—Cartridge fuse links. 21st February, 1958. (817879.)

8153. I-T-E Circuit-Breaker Co.—Bushings for electrical conductors. 12th March, 1957. (817785.)

8978. Philips Electrical Industries, Ltd.—Methods of manufacturing radiation-sensitive sintered bodies containing cadmium sulphide. 19th March, 1957. (817918.)

9731. International Register Co.—Clock-operable electric switches. 25th March, 1957. (817920.)

10292. Electric & Musical Industries, Ltd.—Arrangement and a method for translating graphic characters. 28th March, 1958. (817921.)

10991. Gratzmuller, J. L.—Hydraulically actuated circuit-breakers. 4th April, 1957. (817619.)

13380. Landis & Gyr A.G.—Insulated coils, more especially for electricity meters having a high overload capacity. 26th April, 1957. (817666.)

19796. Brown, Boveri & Cie. A.G.—Coolers for semiconductor cells. 24th June, 1957. (817746.)

20276. Chloride Electrical Storage Co., Ltd.—Lead-acid electric accumulators. 27th March, 1958. (817885.)

23728. Illinois Condenser Co.—Capacitors of the miniature type. 26th July, 1957. (817588.)

23729. General Motors Corporation.—Tuner devices for radio receivers. 26th July, 1957. (Addition to 814500.) (817852.)

26278. Philips Electrical Industries, Ltd.—Pulse correcting circuit arrangements. 20th August, 1957. (817747.)

26522. Westinghouse Electric International Co.—Domestic laundry apparatus. 22nd August, 1957. (817788.)

27069. Standard Telephones & Cables, Ltd.—Molecular beam devices. 28th August, 1957. (817600.)

**1958**

2507. Siemens & Halske A.G.—Electric pulse-delay networks employing transistors. 24th January, 1958. (Addition to 756398.) (818338.)

7400. Alden, M.—Electrical signal recorders. 7th March, 1958. (817630.)

8129. Soc. des Accumulateurs Fixes et de Traction.—Electric storage batteries intended for use in inflammable atmospheres. 13th March, 1958. (817800.)

9656. Shawinigan Chemicals, Ltd.—Automatic electric furnace regulators of the current-voltage balance type. 26th March, 1958. (817618.)

# *NEXT WEEK'S EVENTS*

*Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.*

**MONDAY, 21st SEPTEMBER**

**Birmingham.**—Grand Hotel, 6.15 p.m. Birmingham Electric Club. Presidential Address, "Fire, Steel and Electricity," by R. Paterson.

**Bournemouth.**—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth Branch. "Wiring Cables," by M. P. M. Rowe.

**Leeds.**—Moortown. Electrical Industries National Golf Championship Finals.

**London.**—At the Institution of Electrical Engineers, Savoy Place, W.C.2, 6.15 p.m. A.S.E.E. Education and Training Committee.

**TUESDAY, 22nd SEPTEMBER**

**Newcastle-upon-Tyne.** — Crown Hotel, Clayton Street, 7.30 p.m. A.S.E.E. Newcastle-on-Tyne and District Branch. "Magnetic Amplifiers," by G. L. Horrobin.

**Oxford.**—Employment Exchange, 8 p.m. A.S.E.E. Oxford and District Branch. "Electrical Safety in the Home," by S. J. Emerson.

**Wimbledon.**—Wimbledon Park Golf Club. A.S.E.E. Golfing Society. Hugo Falk Trophy.

**WEDNESDAY, 23rd SEPTEMBER**

**London.**—A.S.E.E. South East London Branch. Visit to the *Daily Express*, Fleet Street, E.C.4.

**Southampton.**—Institution of Plant Engineers, Southern Branch. Visit to Marchwood generating station.

**THURSDAY, 24th SEPTEMBER**

**Chester.**—At the English Speaking Union, Stanley Place, Watergate Street, 7 p.m. Society of Instrument Technology, Chester Section. "Feedback—The Principle of Control," by R. S. Medlock.

**Croydon.**—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. Film, "Power Under Control."

**Glasgow.**—Scottish Building Centre, 425, Sauchiehall Street, 7.15 p.m. Institution of Plant Engineers, Glasgow Branch. "Basic Electronics in Industry and Commerce," by R. H. Garner.

**Hove.**—New Imperial Hotel, First Avenue, 7.30 p.m. A.S.E.E. Brighton, Hove and District Branch. "The I.E.E. Regulations for the Electrical Equipment of Buildings," by S. J. Emerson.

**Liverpool.**—A.S.E.E. Liverpool and District Branch. Visit to Eric Bemrose, Long Lane.

**London.**—Connaught Rooms, W.C.2, 12.30 for 12.50 p.m. Batti-Wallahs' Society. Luncheon. Address by Prof. Sir Albert Richardson.

**Middlesbrough.**—Cleveland Scientific and Technical Institution, Corporation Road, 7 p.m. Institution of Plant Engineers, North East Branch. "The History and Development of Rotary Air Compressors."

**Sheffield.**—Grand Hotel, 7.30 p.m. Institution of Plant Engineers, Sheffield and District Branch. "Rolling Plant," by P. A. Clark.

**Southampton.**—Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "Nuclear and Electrical Space Propulsion Systems," by P. A. E. Stewart.

**THURSDAY, 24th SEPTEMBER to SATURDAY, 26th SEPTEMBER**

**Folkestone.**—Purchasing Officers' Association. Annual conference and "Minibition."

**FRIDAY, 25th SEPTEMBER**

**Birmingham.**—Imperial Hotel, Temple Street, 7.30 p.m. Institution of Plant Engineers, Birmingham Branch. "Works Engineering," by R. T. Wells.

**Blackburn.**—Samlesbury Old Hall. Institution of Plant Engineers, Blackburn Branch. Supper-dance.

**Coventry.**—E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane, 7.45 p.m. A.S.E.E. Coventry and District Branch. Films, "The Skylon" and "The Erection of Oil Filled Cables."

# CATALOGUES AND LISTS

**AIR FILTER.**—Illustrated brochure describing the "Super-Vee" air filter panel.—**Vokes, Ltd.,** Guildford, Surrey.

**CONDUIT FITTINGS.**—36-page illustrated and priced catalogue (17) covering the company's range of conduit fittings.—**F. C. Blackwell & Co., Ltd.,** Great Crosby, Liverpool, 23.

Illustrated and priced 41-page catalogue covering steel conduit, conduit fittings and accessories.—**Metallic Seamless Tube Co., Ltd.,** Ludgate Hill, Birmingham.

**CONTROL GEAR.**—Two leaflets describing new air-break plug-in type master controllers for cranes, rolling mills, coke oven machines and similar applications.—**Allen West & Co., Ltd.,** Brighton, 7.

**INSPECTION EQUIPMENT.**—Booklet illustrating and describing optical and lighting equipment for visual inspection.—**P. W. Allen & Co.,** 253, Liverpool Road, London, N.1.

**LIFTS.**—Leaflet giving plans, illustrations and dimensions of standard passenger lifts.—**Marryat & Scott, Ltd.,** Wellington Works, Hounslow, Middlesex.

**LIGHTING FITTINGS.** — Brochure (P.2731) illustrating in colour the "Olympus" range of lighting fittings.—**Falk, Stadelmann & Co., Ltd.,** 91, Farringdon Road, E.C.1.

Brochure covering a range of special lighting fittings for use in mines, quarries and heavy industry.—**Fibalite, Ltd.,** 117, Granville Street, Birmingham, 1.

Brochure and descriptive literature dealing with a fluorescent lighting fitting for operation by a standard 12 V vehicle battery.—**Barber Electrical Services, Ltd.,** The Airport, Weston-super-Mare, Somerset.

**OPTICAL DIGITISER.** — Illustrated brochure (CT.132/2) describing the company's neon type optical digitiser.—**Hilger & Watts, Ltd.,** 98, St. Pancras Way, London, N.W.1.

**PROCESSING EQUIPMENT.** — Illustrated booklet (12) describing "Chal" industrial heating plant for the electrical industries.—**Controlled Heat & Air, Ltd.,** Smethwick.

**WELDING.**—Brochure describing the "Sifbronze 101" welding process.—**Suffolk Iron Foundry (1920), Ltd.,** Stowmarket, Suffolk.

**WINCHES.**—Broadsheet (33.SC) giving data and illustrations of three new electrically powered winches.—**Laurence, Scott & Electromotors, Ltd.,** Norwich.

**WINDING EQUIPMENT.** — Brochure (B.3) giving details of the company's range of winding equipment, including a bobbin and transformer winder, a toroidal winding machine and paper cutting machines.—**Frank Whitelegg, Ltd.,** 304, High Street, Sutton, Surrey.

**WIRING ACCESSORIES.**—59-page catalogue and price list covering the company's range of switches, plugs and sockets, fuses, and steel boxes.—**E.F. Electric, Ltd.,** Willow Lane, Watford, Herts.

38-page catalogue (27) together with separate price list covering the company's range of electrical accessories, appliance connectors, bell transformers and terminal blocks.—**Ashley Accessories, Ltd.,** Ulverston, Lancs.

Illustrated folder dealing with metalclad 13 A sockets and switchsockets in surface and flush types.—**T.M.C.-Harwell (Sales), Ltd.,** 37, Upper Berkeley Street, London, W.1.

# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses*

**Australia.**—Electricity Commission of New South Wales, Sydney. 6th October. 330 kV isolating and earthing switches, insulator stacks and supporting structures. (E.S.B. 20352/59. Ten/41525.)* 12th October. 132 kV isolating switches. (E.S.B. 20649/59. Ten/41615.)* 7th December. 75 MVA synchronous condensers. (E.S.B. 19769/59. Ten/41365.)*

Postmaster General's Department, Melbourne. 8th October. Lamps, lamp caps and lamp jacks. (E.S.B. 20200/59. Ten/41489.)* 29th October. Electron tubes. (E.S.B. 21466/59. Ten/41836.)*

Victorian Railways, Melbourne. 23rd September. Electric lamps. (E.S.B. 21376/59. Ten/41774.)*

**Burma.**—Burma Purchase Board, Rangoon. 23rd September. Electric lighting fittings. (E.S.B. 21711/59. Ten/41879.)*

**Formosa.**—Central Trust of China, Taipei. 1st October. Two induction motor-generator sets and electrical apparatus. (E.S.B. 20913/59/I.C.A. Ten/41639.)*

**Greece.**—Ministry of National Defence, Athens. 14th November. Airfield electronic installations. (G.D. 5682/58. Ten/41740.)*

Ministry of Finance, Athens. Cables. (E.S.B. 21410/59. Ten/41784.)*

**Ilford.**—Corporation. 27th October. Group "B" street lighting equipment. (See this issue.)

**India.**—National Coal Development Corporation, Ltd., Calcutta. 28th September. 300 kVA transformer and oil circuit-breakers. (E.S.B. 21531/59. Ten/41830.)* 29th September. Four 25 MVA oil circuit-breakers. (E.S.B. 21532/59. Ten/41826.)* 30th September. Sixty-four oil circuit-breakers. (E.S.B. 21533/59. Ten/41834.)*

**Isle of Ely.**—County Council. 5th October. Washing machine. (11th September.)

**Korea.**—Government Office of Supply, Seoul. 2nd October. Telephone apparatus and public address equipment. (E.S.B. 21128/59/I.C.A. Ten/41718.)*

**New Zealand.**—Metropolitan Drainage Board, Auckland. 7th October. Switchboards. (E.S.B. 20394/59. Ten/41529.)*

G.P.O., Wellington. 14th October. Telephone cable. (E.S.B. 20880/59. Ten/41632.)*

New Zealand Forest Service, Wellington. 23rd October. One 250 kW generating set. (E.S.B. 21130/59. Ten/41708.)*

Dunedin Electricity Department. 23rd October. Distribution transformers. (E.S.B. 20879/59. Ten/41628.)*

**Pakistan.**—West Pakistan Water and Power Development Authority, Lahore. 15th October. Control room equipment for Daudkhel grid station. (E.S.B. 19786/59. Ten/41506.)*

**Skipton.**—U.D.C. 5th October. Group "B" street lighting equipment. (See this issue.)

**South Africa.**—Stores Department, South African Railways, Johannesburg. 2nd October. 3-channel carrier systems. (E.S.B. 21291/59. Ten/41737.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

**Sudan.**—Stores Department, Sudan Railways, Atbara. 19th October. Train lighting dynamos. (E.S.B. 21372/59. Ten/41738.)*

**Thailand.**—Irrigation Department, Bangkok. 8th October. Power transformers. (E.S.B. 20156/59. Ten/41471.)*

### ORDERS PLACED

**Durham.**—County Education Committee. Electrical work in schools:—Hurworth New Modern School (£5,122) and Neville's Cross Training College (£9,767).—Cox Walkers. Wingate A. J. Dawson Grammar School (£2,128).—North of England Engineering & Electrical Co.

**Hartlepool.**—Corporation. Installation of electric street lighting in place of gas in minor roads (£15,963).—Revo Electric Co.

**Peterborough.**—Joint Education Board. Electrical installation work for extension to the engineering block at the Peterborough Technical College (£2,718).—D. J. Spire & Co.

**South Shields.**—Corporation. Electrical work in connection with the new Highfield Infants' School, South Shields (£2,108).—A. Robertson.

**Sunderland.**—Corporation. Wiring of 129 houses, Hylton Red House and Plains Farm estates (£3,214).—Gee & Brown.

**Whitley Bay.**—Borough Council. Electrical installations in 38 houses, Millfield estate, Seaton Sluice (£1,015).—Norie Construction.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors*

**Aberdare.**—Housing scheme, Maesgwyn site, Cwmdare; C. D. C. Braine & Partners, consulting engineers, 26, St. Mary Street, Cardiff.

**Barnstaple.**—Bungalows (160), Shorelands Road; W. Woolaway & Sons, Ltd., Junction Yard.

**Boldon (Co. Durham).**—Housing estate, Dipe Lane, for the Church Commissioners; Smith, Gore & Co., Ltd., surveyors, 81, Bondgate, Darlington.

**Bristol.**—Showrooms and offices, Merchant Street; Ravenseft Properties, Ltd., 52, Charles Street, London, W.1.

**Carlisle.**—Egg canning station, Harraby; John Laing & Sons, contractors, Dalston Road.

**Chichester.**—College of Further Education; county architect, County Hall.

**Corby.**—Library, George Street; county architect, Northampton.

**Crawley.**—Nurses' home; Yorke, Rosenberg & Mardall, architects, 2, Hyde Park Place, London, W.2.

**Darlington.**—Factory building extensions, Aycliffe trading estate; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street, Co. Durham.

Comprehensive school, Branksome; E. A. Tornbohm, borough architect.

**Dorset.**—Secondary modern and infants' schools, Hillbourne; county architect, County Hall, Dorchester.

**Ellesmere Port.**—Development of new town centre with provision for shops, offices and civic library; surveyor, Ellesmere Port, Wirral, Cheshire.

**Fenny Stratford.**—Industrial estate; Percy Bilton, Ltd., 113, Park Street, London, W.1.

**Gateshead.**—Factory additions, Team Valley Estate, for Sigmund Pumps, Ltd.; A. Monk & Co., contractors, Albert Road, Middlesbrough.

Hotel (200 bedrooms) for Aycliffe Properties, Ltd.; J. Moffitt, architect, 37, Cheviot View, Ponteland, Northumberland.

Houses (218), Leam Lane, for the North Eastern Housing Association; G. F. Winters, borough engineer, Municipal Buildings.

**Glasgow.**—Four 17-storey blocks of houses, Hutchesontown/Gorbals development; director of housing, 20, Trongate.

**Hanworth.**—Passenger buildings, London Airport; Fredk. Gibberd, architect, 8, Percy Street, London, W.1.

**Haslingden.**—Office block, Albion Mill, Helmshore; L. Whitaker & Son, Ltd., Crane Road Mill.

**Hawick.**—Extensions to factory, Teviot Road; Pringle & Son, Ltd., Rodono Mills.

**Hemel Hempstead.**—Office block, Waterhouse Street, for the Development Corporation; G. B. S. Hindley, chief engineer, Westbrook Hay, Hemel Hempstead, Herts.

**Hessle.**—Works and offices; Johns-Manville & Co., Ltd., 20, Albert Embankment, London, S.E.11.

**Hull.** — Comprehensive schools, near Orchard Park Road and in Rensburg Street; W. Morris, city engineer.

**Isle of Man.**—School, Castletown; Davidson, Marsh & Co., architects, 16-18, Athol Street, Douglas.

**Isleworth.**—Office block, London Road; Tersons, Ltd., 4, Dollis Park, London, N.3.

**Kesteven.**—Old people's home, Gorse Road, Grantham (£42,000), and secondary modern schools at Billingborough, Billinghay and Corby Glen; county architect, County Offices, Sleaford, Lincs.

**Leeds.** — Seven-storey building, South Parade, for the London & Lancs. Insurance Co., Ltd.; Charlton & Crowther, architects, 21, Bond Street.

**Leicestershire.**—Science block at Loughborough College School; county architect, 123, London Road, Leicester.

**London.**—Hotel, shops, offices and flats, Kensington High Street; Eron Investments, Ltd., 19, Hill Street, W.1.

Flats (380), Avondale Square, Southwark; Pauling & Co., Ltd., 26, Victoria Street, S.W.1.

**Macclesfield.**—Development at Upton with provision for about 1,000 houses, shops, school and other buildings; borough architect, 3, Jordangate.

**Maidstone.**—Eight-storey block of flats, Waterloo Street clearance area; borough engineer, Palace Avenue.

**Morden.**—170ft block of offices, Crown Lane; E. Alec Colman Group, 23, Fitzroy Street, London, W.1.

**Newcastle-on-Tyne.** — Swimming baths, Montagu estate; Cackett, Burns Dick & Mackellar, architects, 21, Ellison Place.

**Newmarket.**—Grammar school (first phase); West Suffolk county architect, 13, Westgate Street, Bury St. Edmunds.

**Norwich.**—Block of shops and offices, Davey Place; A. F. Scott & Sons, architects, 23, Tombland, Norwich.

**Northumberland.**—Four schools under the E.C.'s 1960-62 building programme; Gilbert Ash, Ltd., contractors, Stanhope Gate, London, W.1.

**Nottingham.**—Science block and assembly hall, Mundella Grammar School; A. F. Houfton & Co., Ltd., 8, Coventry Road, Bulwell.

[*Continued on next page*

**WORK IN PROSPECT** (*continued*)

**Oxford.**—New headquarters for Hospital Board (£132,475); Architects' Department, Oxford Regional Hospital Board, 43, Banbury Road.

Multi-storey trim shop for Pressed Steel Co., Ltd.; Holland & Hannen and Cubitts, Ltd., 1, Queen Anne's Gate, London, S.W.1.

**Plymouth.**—Flats (84), Devonport; city architect.

**Seaton Delaval (Northumberland).**—Proposed housing estate; William Leech, Ltd., builders, St. James Street, Newcastle-upon-Tyne.

**Stockton-on-Tees.**—Factory additions for North-Eastern Trading Estates, Ltd.; J. S. Houghton, architect, 57, High Street, Stockton.

Factory additions for F. Hills & Son, Ltd.; Middleton & Partner, architects, 111, Albert Road, Middlesbrough.

**Walsall.**—Operating theatre suite and X-ray department, Manor Hospital; Birmingham Regional Hospital Board, 10, Augustus Road, Birmingham, 15.

**Washington (Co. Durham).**—Factory extensions for Pawsons Washington, Ltd.; G. J. Cash, architect, 3, Ward Ends, Halifax.

**Whickham (Co. Durham).**—Factory additions, Pennyfine Road, for James & Co.; E. Arnold, architect, 21, Jenifer Grove, Newcastle-on-Tyne.

**Whitehaven.**—Factory extensions for Smith Brothers; John Laing & Sons, contractors, Dalston Road, Carlisle.

**Wirral.**—Extensions and alterations to Council Offices, Heswall; Quiggin & Gee, architects, 11, Oldhall Street, Liverpool, 3.

**York.**—Extensions (£215,000), St. John's Teachers' Training College; York diocesan surveyor, 8, Minster Yard.

# NETHERLANDS ELECTRICAL TRADE

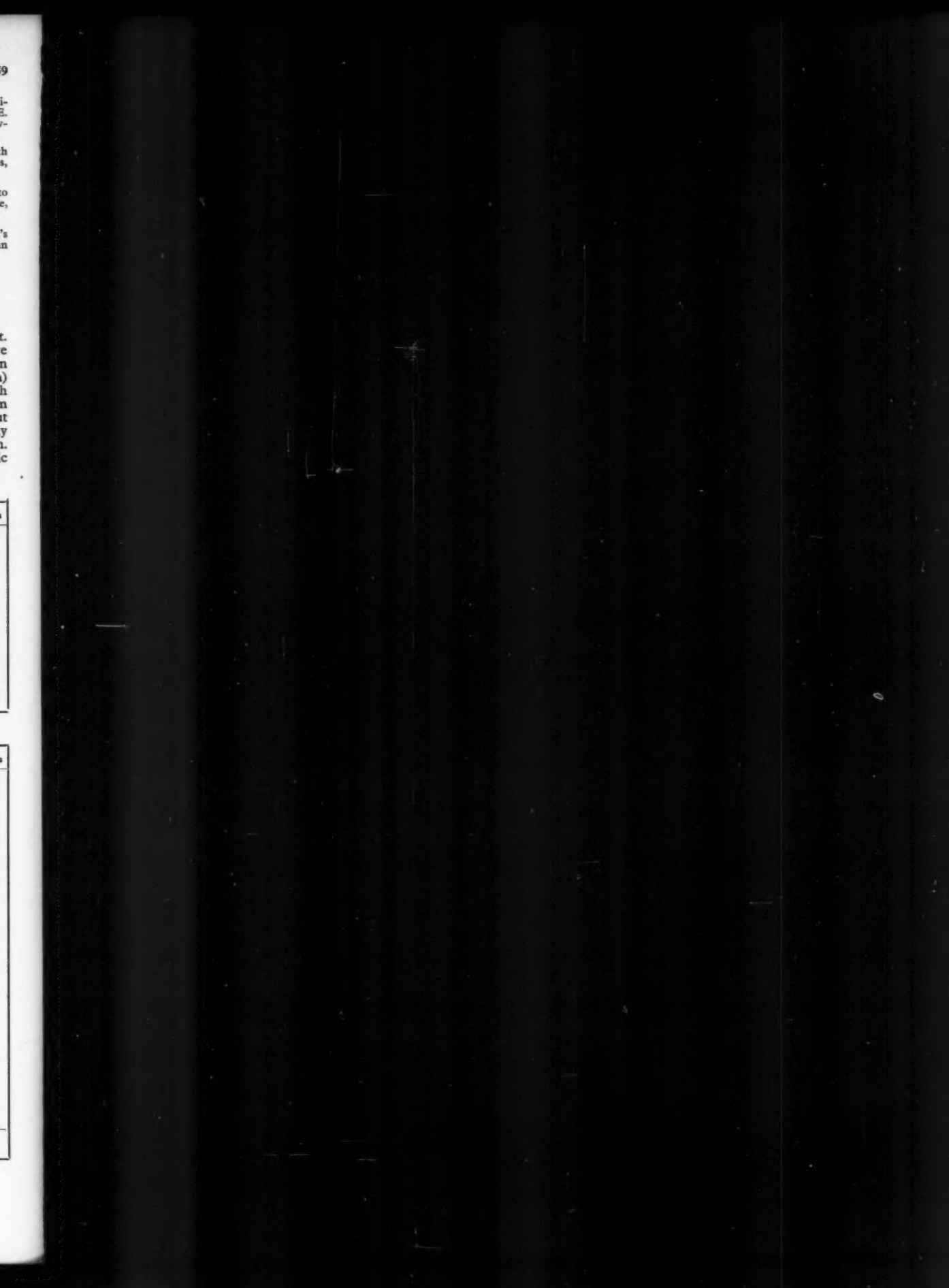
LAST year the Netherlands was the world's fourth largest exporter of electrical goods and the second largest importer. Electronic equipment is an important element in the country's overseas trade but though exports of these goods rose last year from £36 million to £40·4 million they formed a slightly lower proportion of total exports. Because of the dominant position of the Philips organisation detailed figures for electronic equipment are not always released.

Total Netherlands exports of electrical goods rose by 18 per cent last year, from £69 million to £81·5 million. Imports dropped during the same period from £68·5 million to £67·3 million. As in previous years a large part of the country's trade was with the other members of the Common Market; the ratio for exports was 35 per cent and for imports 70 per cent. Other important export markets were the United States (£4 million), Sweden (£7 million), Denmark (£3 million) and Switzerland (£2·6 million). Dutch exports to the United Kingdom remained stable at £4·1 million, but imports from this country fell slightly from £7·9 million to £7·6 million. Electronic equipment and domestic appliances were the leading items.

**Netherlands Electrical Imports and Exports by Countries, 1958 (£000)**

| Country | Imports | Exports | Country | Imports | Exports | Country | Imports | Exports |
|---|---|---|---|---|---|---|---|---|
| United Kingdom | 7,648 | 4,124 | Greece | 2 | 615 | Chile | — | 315 |
| Belgium/Luxembourg | 21,700 | 12,510 | Poland | 1 | 763 | Brazil | 1 | 753 |
| France | 2,960 | 3,040 | Turkey | — | 234 | Argentina | 4 | 1,112 |
| West Germany | 21,210 | 10,511 | Morocco | 2 | 313 | Cyprus | — | 255 |
| East Germany | 103 | 6 | Egypt | — | 711 | Saudi Arabia | — | 351 |
| Eire | 82 | 308 | Belgian Congo | — | 235 | Iraq | — | 573 |
| Norway | 217 | 1,243 | Nigeria | — | 236 | Iran | — | 705 |
| Sweden | 1,457 | 7,215 | South Africa | 5 | 765 | Indonesia | — | 1,144 |
| Finland | 38 | 1,033 | Rhodesia and Nyasaland | — | 185 | Pakistan | — | 236 |
| Denmark | 1,044 | 2,893 | United States | 3,652 | 4,056 | India | 3 | 695 |
| Switzerland | 3,322 | 2,588 | Canada | 210 | 1,160 | Ceylon | — | 382 |
| Austria | 701 | 2,397 | Mexico | 3 | 765 | Thailand | — | 458 |
| Czechoslovakia | 84 | 188 | Cuba | 2 | 395 | Malaya | — | 334 |
| Hungary | 73 | 45 | Dutch Antilles | — | 561 | Singapore | 7 | 514 |
| Portugal | 4 | 1,003 | Colombia | 6 | 543 | Japan | 615 | 121 |
| Spain | 54 | 605 | Venezuela | 5 | 1,572 | China | — | 209 |
| Italy | 742 | 2,126 | Surinam | 3 | 242 | Hongkong | 12 | 254 |
| Yugoslavia | 24 | 327 | Peru | 2 | 635 | Australia | 36 | 1,511 |
| | | | | | | New Zealand | 6 | 615 |

**Netherlands Electrical Imports and Exports by Product in 1958 (£000)**

| Product | Imports | Exports | Product | Imports | Exports | Product | Imports | Exports |
|---|---|---|---|---|---|---|---|---|
| Steam turbines | 1,130 | 173 | Flat irons | 250 | 115 | Telephone equipment | 2,920 | 1,166 |
| *United Kingdom* | 176 | 25 | *United Kingdom* | 27 | — | *United Kingdom* | 184 | 18 |
| *Belgium/Luxembourg* | 25 | 13 | *Belgium/Luxembourg* | 35 | 29 | *Belgium/Luxembourg* | 1,390 | 183 |
| *West Germany* | 685 | 83 | *West Germany* | 187 | 59 | *France* | n.a. | 124 |
| *Switzerland* | 106 | 21 | *Portugal* | n.a. | 11 | *Denmark* | n.a. | 173 |
| *Sweden* | — | 17 | Furnaces | 92 | 166 | *West Germany* | 464 | n.a. |
| *United States* | 38 | — | *United Kingdom* | 57 | 21 | *Sweden* | 618 | n.a. |
| Motors and parts | 3,500 | 1,113 | *Belgium/Luxembourg* | 4 | 32 | *Switzerland* | 310 | n.a. |
| *United Kingdom* | 572 | 53 | *West Germany* | 21 | 51 | Switches, sockets and fuses | 1,450 | 171 |
| *West Germany* | 1,658 | 236 | *Canada* | n.a. | 12 | *United Kingdom* | 57 | 18 |
| *Belgium/Luxembourg* | 500 | 411 | *Indonesia* | n.a. | 17 | *Belgium/Luxembourg* | 231 | 38 |
| Transformers and chokes | 2,700 | 572 | Filament lamps | 1,440 | 3,509* | *West Germany* | 908 | 22 |
| *United Kingdom* | 295 | 21 | X-ray tubes | 82 | 366* | *Sweden* | n.a. | 19 |
| *Belgium/Luxembourg* | 1,310 | 288 | Radio and TV receivers | 13,830 | 23,414* | *Italy* | 81 | n.a. |
| *West Germany* | 708 | 49 | Radio valves and tubes | 7,810 | 14,723* | Apparatus for regulating and distributing | 6,420 | 3,006 |
| Static convertors | 810 | 711 | Amplifiers | 275 | 551* | *United Kingdom* | 700 | 63 |
| *United Kingdom* | 162 | 29 | Loudspeakers and microphones | 1,060 | 633 | *Belgium/Luxembourg* | 881 | 461 |
| *West Germany* | 280 | 112 | *United Kingdom* | 44 | 13 | *France* | 315 | 61 |
| *United States* | 172 | n.a. | *Belgium/Luxembourg* | 795 | 65 | *West Germany* | 2,610 | 471 |
| *France* | n.a. | 262 | *West Germany* | 133 | 75 | *Sweden* | n.a. | 435 |
| Vacuum cleaners and parts | 532 | 1,433 | Voltmeters and ammeters | 166 | 61 | *Denmark* | 242 | 231 |
| *United Kingdom* | 41 | 213 | *United Kingdom* | 40 | 9 | *Switzerland* | 850 | 107 |
| *Belgium/Luxembourg* | 171 | 214 | *Belgium/Luxembourg* | 4 | 5 | *United States* | 563 | n.a. |
| *West Germany* | 32 | 192 | *West Germany* | 78 | 13 | Cables and wires | 1,953 | n.a. |
| *Norway* | n.a. | 115 | Other instruments | 560 | 1,466 | *United Kingdom* | 249 | n.a. |
| *Sweden* | 106 | 170 | *United Kingdom* | 69 | 103 | *Belgium/Luxembourg* | 1,006 | n.a. |
| *Switzerland* | n.a. | 111 | *Belgium/Luxembourg* | n.a. | 77 | *West Germany* | 624 | n.a. |
| *Austria* | n.a. | 115 | *France* | n.a. | 241 | *United States* | 33 | n.a. |
| Household washing machines | 1,670 | 572 | *West Germany* | 225 | 373 | Parts and components of electrical machinery and equipment n.e.s. | 4,620 | 4,688 |
| *United Kingdom* | 168 | 143 | *Sweden* | n.a. | 158 | *United Kingdom* | 891 | 335 |
| *Belgium/Luxembourg* | 130 | 61 | *United States* | 191 | n.a. | *Belgium/Luxembourg* | 630 | 672 |
| *West Germany* | 1,320 | 75 | Household meters | 308 | 15 | *West Germany* | 1,145 | 1,221 |
| *United States* | n.a. | 158 | Telegraph equipment | 267 | 123 | *France* | 430 | 232 |
| Refrigerators, up to 2m³ | 1,280 | 44 | *United Kingdom* | 51 | 42 | *Switzerland* | 389 | 198 |
| *United Kingdom* | 104 | — | *Canada* | n.a. | 22 | *United States* | 582 | 441 |
| *Belgium/Luxembourg* | 106 | 14 | *West Germany* | 199 | — | | | |
| *West Germany* | 620 | 15 | | | | | | |
| *Sweden* | 172 | — | | | | | | |

* Figures for individual countries not available. n.a. = not available.